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Abstract

To obtain an overall view of the auditory training equipment used in California, 27 different models of nine makes of auditory training systems were subjected to an acoustical, quality control, and educational analysis. The test methods used were those of the hearing aid industry. An analysis of questionnaires sent to teachers, speeches by Hyman Goldberg and Richard S. Campbell on amplification systems, definitions used, and procedures followed are provided. Physical descriptions and assessments of quality, performance, and educational suitability are given for each piece of equipment. Recommendations include suggestions that the industry work more closely with schools in designing systems and equipping classes, and that studies should be made at 3-year intervals to assure continuing improvements in educational amplification equipment. Appendixes include the educational questionnaire, a harmonic distortion guide, and a list of the manufacturers. (JM).

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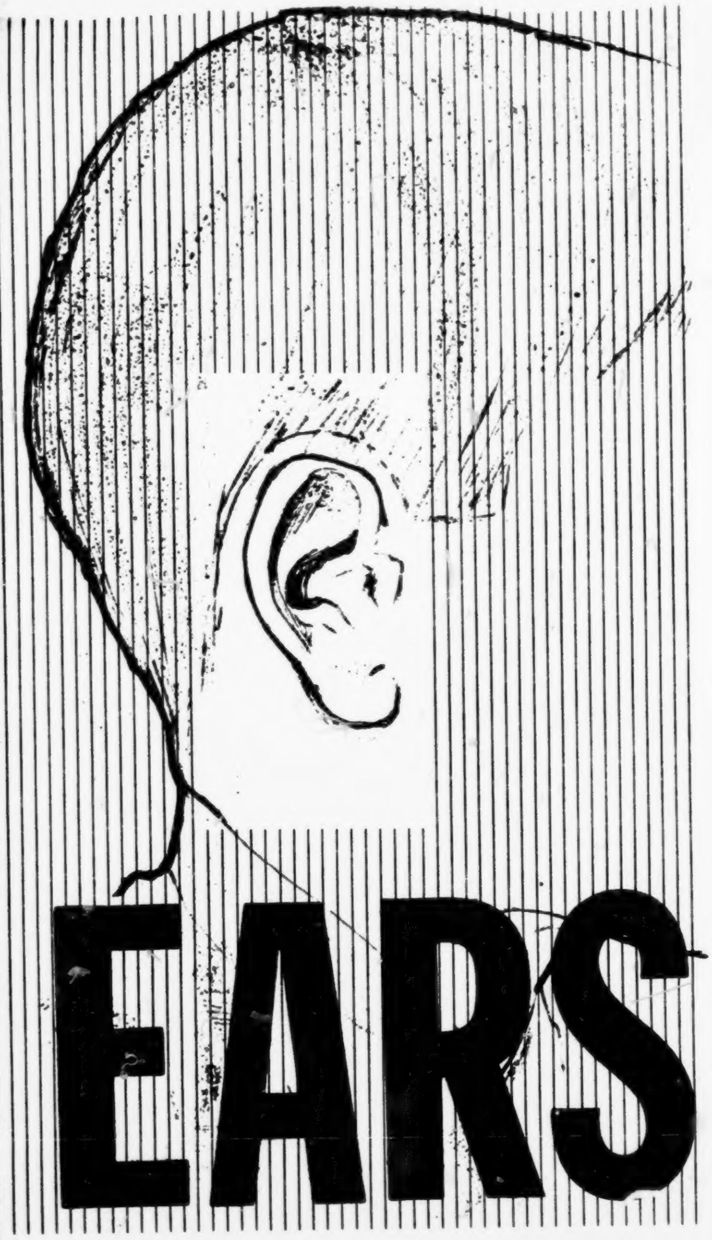

EARS

Educational Amplification Response Study 1968

EARS MONOGRAPH NO. 1

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EDUCATIONAL AMPLIFICATION RESPONSE STUDY

E. A. R. S.

This is a report of a study conducted by the California State Department of Education with the services of the San Diego Speech and Hearing Center and educators of the deaf in California. This study was supported by a grant awarded under provisions of Title VI-A, ESEA, 89-10, as amended.

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FOREWARD

This report is the first in what is hoped will be a series of publications dealing with electronic auditory training systems. The need for a standard method of presenting information about the various available systems has been long in need. We are not so presumptuous as to assume that the method of reporting, as exercised in this publication, should set the standard for future reporting. We have attempted, however for the purpose of this publication to keep our reporting (dialogue) concerning each individual instrument as uniform as possible. In the quality assurance and acoustical evaluation sections of the study, we have held to the minimum NASA and HAIC standards except where we felt higher standards might be desirable or where standards have not as yet been set.

In reviewing our work, we find questions which are left unanswered and areas which could be expanded upon in considerably more detail. There is also a profuse amount of raw data recorded that will more than delight the statistician interested in delving into our data in greater depth. The time limits imposed on this study were from June 11, 1968 to August 31, 1968 in which time all the data had to be gathered, a consultants workshop held, and the report published. What we have learned as a result of this study we will most certainly apply to any future study including the allotment of more time for data collecting and reporting.

This study has been one of fascinating interest both to myself, my staff and to our consultants who gave so generously of their time and thoughts. We hope that we have contributed to both the educational field and to those members of industry whose systems have been studied in this first endeavor. In this light we do sincerely hope that the manufacturers will look on the results and findings and observations contained in the report as true constructive criticism to aid them in developing a better and more effective product for use in schools where the deaf and hard of hearing are taught.

DONALD F. KREBS

PREFACE

PRESENT SPECIAL EDUCATION PROGRAM AND ACTIVITIES

There are 75 special day class programs and special schools maintained by district and county superintendents to provide for the education of deaf and severely hard of hearing minors in California. These programs serve approximately 3500 minors at the present time.

Deaf and severely hard of hearing minors served in these programs are provided a full curriculum. One of the essential differences in the program for these children is the emphasis which is placed on necessary communication training. A crucial factor in providing communication training is the quantity and quality of the amplification system for instructional purposes. It is customary for every special class for these minors to be equipped with an amplification system which affords every child the benefit of developing and using his residual hearing to the best possible education advantage.

With approximately 400 special classrooms in existence throughout California's public schools it is estimated that between 5% and 20% of these classes are provided new or replacement amplification systems during any given school year. With the current average price of $3000.00 per classroom amplification system, the usual annual investment made in California for educational amplification systems is between $60,000.00 and $240,000.00.

Present practice in selecting a system from among the several vendors of such amplification equipment is made by supervisory personnel and classroom teachers of the deaf using in-service meetings to evaluate which system to purchase for use in the classrooms of the district or county aural education program. While there is much merit in using this approach to the selection of such systems, supervisors and classroom teachers have no acoustic or instructional criteria upon which to base any evaluation. Too often these professionals have had to rely upon the integrity of the commercial vendor and their own subjective arguments as to the pros and cons of the various systems available to them for selection and purchase. In some instances, some vendors allow programs to test equipment for limited periods of time. The recipients of their decisions are, naturally, the deaf and severely hard of hearing children whom they teach.

One of the unmet needs is the task of providing valid and reliable criteria encompassing both acoustic and instructional features which teachers and administrators may use as guidelines in making the critical decision to secure educational amplification for deaf and severely hard of hearing minors. Such a valid and reliable criteria would eliminate decisions weighing too heavily on the sales promotion of commercial vendors and subjective arguments,and would greatly facilitate selection without timely trials of several systems. Criteria of this nature would assist a large number of smaller programs which do not have the required personnel or time to study this matter carefully.

Barry L. Griffing & Gordon M. Hayes

Consultants in Education of the Deaf and Hard of Hearing

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INTRODUCTION

Teachers of the hearing handicapped, school administrators, and manufacturers must all be aware of certain human factors involved in the use of present day electronic auditory training systems. The most important human factor in this discussion is the child and his hearing loss.

This study would therefore like to pose a few questions to the person in the school and also to the manufacturer. To the teacher it asks: Do you really understand the acoustic characteristics of your classroom auditory training system? Are you certain that the system you are using is acoustically better suited to your students hearing loss than their own hearing aids? We can assume that all systems have a means of adjusting the gain, but does it have any means by which the power output can be adjusted? Does it have any means by which the frequency response can be adjusted? If it does have a power output adjustment, how is this accomplished? Is it accomplished by peak clipping which adds distortion components to an already artificially sounding signal or by compression amplification? If limiting the output is accomplished by compression amplification, how fast is the system reacting to changes in intensity? A slow acting compression amplifier is sometimes worse than a signal distorted by peak clipping. If the systems in your classroom are adjustable somewhat to the childs acoustic needs who determines what these adjustments should be? When a child has been correctly fitted with hearing aids much professional time and effort has gone into the selection of the proper instrument and adjustments within that instrument. Should any less time be spent in adjusting an auditory training system to his acoustic needs?

To the manufacturer the study might ask how he established his design criteria? Was this done after much research into the needs of the hearing handicapped? Why isn't your system as flexible as some hearing aids? Why hasn't the industry set standards in, for instance, the marking of controls? In reporting the response characteristic of your equipment do you use the same systems of reporting such as is used in the Hearing Aid Industry Conference (HAIC)? If not why not? Also, very few manufacturers have developed manuals that are very useful to a teacher as far as her most effective use of the equipment is concerned. Many other questions could be posed to the manufacturers which would be redundant to some and new to others. Perhaps in reviewing our findings, a spark of new ideas will be born; we sincerely hope so.

The Acoustical Evaluation data gathered in this study has been done in as standard a way as humanly possible. The equipment used to gather the data is fairly standard throughout the hearing aid industry and will be described later.

The Quality Assurance Evaluation was conducted by a person who has an excess of 25 years of successful experience in this highly technical field in aircraft and then in the aerospace industry. The direction given to him was to evaluate each instrument from the standpoint of other than factory service or maintenance. In other words, if factory authorized service is too far distant to be practical, would it be feasible for a local repair or maintenance facility to service the instrument. From the manufacturers standpoint this may be an unfair approach; however, in our teacher survey it appears that this is a common complaint and one that should be solved. Quick service, preferably local, is essential to teacher and administrative acceptability of auditory training systems.

In addition each system was analyzed along the following dimensions when appropriate: case, markings, general arrangements, solder, workmanship, maintainability, and parts.

The Educational Evaluation was conducted by experienced teachers of the deaf, supervisor of instruction, administrator, consultants and audiologists. Those responsible for the Education Evaluation represented districts, county and state services, both elementary and secondary levels, both private and public school programs including day and residential type and private agencies serving the hearing handicapped.

The task of making an Education Evaluation was dictated by the suitability of the systems under study in the instructional programs for deaf and severely hard of hearing children presently enrolled in programs in California. The evaluation was made along the following dimensions:

Description of the physical features
Quality of the system and components
Performance
Educational suitability
(Age, level, type of program and
classification - deaf or hard of
hearing)

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EDUCATIONAL SURVEY

E. A. R. S. QUESTIONNAIRE

In Developing the educational survey for this project, we first sent out a trial survey to the teachers of hearing handicapped in the San Diego City Unified School district and the Chula Vista Elementary School district. A nearly 100% return enabled us to develop a more comprehensive questionnaire which we sent out to a sampling of various school districts throughout the state of California. An analysis of the questionnaire follows. A copy of the questionnaire, as it was finally sent out, can be found in the Appendix section of this report.

EDUCATIONAL AMPLIFICATION RESPONSE STUDY

RESPONSE TO THE E.A.R.S. QUESTIONNAIRE

The purpose of the E.A.R.S. questionnaire was to obtain an overall view of the use of auditory training equipment throughout the state of California. The questionnaire was divided into four main categories. The first category was concerned with characteristics of the student population using auditory training equipment. The second category was concerned with the characteristics of the environment in which the equipment is used, i.e., the classroom. The third and largest set of questions was in the category of equipment used and its value in the classroom as judged subjectively by the teachers. The fourth category dealt with maintenance and operating problems of auditory training equipment in use.

A pilot questionnaire was first sent out to teachers in the San Diego area. From their response and comments, questions were revised and reworded for greater clarity. The revised questionnaire was then sent out to a select sample of teachers throughout the state.

The response rate was limited since the questionnaire was sent out just before the close of school. In this case, the questionnaire was sent to 30 teachers in Southern California and to 25 teachers in northern California. The northern California teachers responded with a 95% return rate. Southern California's return rate was 46%. A grand total of 35 forms were filled out and returned for a combined response rate of 70%.

The amount of recoverable information contained in the form was reduced further because many questions were either not answered or the answer did not seem to fit the question asked. In other cases, a question may have been answered but was answered incompletely so that its value was diminished.

The questionnaire forms were sent to specific teachers selected from the Directories of Special Education Programs for the Deaf and Hard of Hearing for Northern and Southern California. In some cases the teachers selected from the directory handed the forms to other teachers. In a few cases, the entire staff of the school met, reviewed the questions and formulated group opinion as answers to the questions. While this increased the coverage in terms of numbers, it also increased the difficulty of focusing direct answers to specific questions.

The information gathered from the questionnaire is presented here in raw form. There was no attempt made to perform any statistical analysis. For the most part the answers speak for themselves. It must be stated also that the teachers chosen to receive the form were not selected on a random basis. They were specifically selected to provide a representative sample of the geographic areas in terms of the number of teachers in the northern and southern California areas. In addition, the sample had to represent, as closely as possible, all ages in the student population and had to go to those teachers who are actually using auditory training equipment. Approximately 28% of the classrooms either do not have auditory training equipment, or have it but do not use it.

Table 1 - Number of teachers in public school system classes for the hard of hearing and deaf.*

Northern California 1967-68	159
Southern California 1967-68	245
(does not include faculty of Riverside or Berkeley Schools) Total	404

* Directory of Special Education Programs for Deaf and Hard of Hearing Children -- Northern and Southern California. State Dept. of Education 1968.

Table 2 - Number of students in public school system classes for the hard of hearing and deaf.*

	Deaf	Hard of Hearing	Total
Northern California 1967-68	681	523	1,204
Southern California 1967-68	1,201	922	2,123
(does not include students in Riverside or Berkeley Schools with approximately 500 students each.)		Total	3,327

* Directory of Special Education Programs for Deaf and Hard of Hearing Children -- Northern and Southern California. State Dept. of Education 1968.

CATEGORY 1 - STUDENT POPULATION

A count of the students reported by the teachers in the 35 forms returned revealed a total of 389 students or a little over 10% of the total student population. Their ages ranged from 2 1/2 years to 19 years. Average age for the group was 6 years.

Question Ib of the form asked for a breakdown of the number of children in each of the following ranges of hearing loss and included a request for individual audiograms if possible.

Table 3 - Number of children in each hearing loss category.

a.	Mild hearing loss	20-40 dB	13
b.	Moderate hearing loss	40-60 dB	79
c.	Severe hearing loss	60-80 dB	119
d.	Profound hearing loss	80 dB	178
		Total	389

As could be expected, the largest number of students fell in the severe to profound hearing loss category. Only a little over 3% of the students fell in the mild loss range.

The average amount of time the students spend at the school was estimated at approximately four hours. The reported time ranged from one and a half hours for a pre-school group to seven hours for a teen-age group. The majority have a school day of from three to five hours.

In comparing the length of the class day to the amount of estimated time the auditory training equipment is in use, we found that the majority (about two-thirds) estimated their equipment to be in use over 50% of the time. Four classrooms or 13% of the total reporting estimated using the equipment from 0 to 10%, and one respondent stated it was never used (system is 18 years old). See table 4.

Table 4 - Estimated per cent of time equipment was in use for classroom reporting

Time	Number of Classrooms
0 - 10%	4
10 - 20%	0
20 - 30%	3
30 - 40%	4
40 - 50%	0
50 - 60%	6
60 - 70%	3
70 - 80%	5
80 - 90%	3
90 -100%	4
Total	32

Almost all of the children in the classes have been tested and provided with individual hearing aids. The largest number of these children (130) have monaural hearing aids. Only 64 were reported as having binaural hearing aids. Twenty-one have monaural aids with "Y" cords and two receivers.

In comparing the ages of those children with binaural aids with those with monaural aids there appears to be a trend toward providing more children with binaural hearing aids. In the older age group (8 years and up) there is a ratio of slightly more than three to one in favor of monaural hearing aids. In the younger children - those most recently provided with hearing aids - there is almost a one to one ratio (1.3:1) of monaural to binaural.

Table 5 - Binaural and monaural hearing aids by age groups

Number of binaural hearing aids reported for children 3 - 7 years	39
Number of binaural hearing aids reported for childred 8 years and older	25
Number of monaural hearing aids reported for children 3 - 7 years	52
Number of monaural hearing aids reported for children 8 years and older	78

Many of the respondents commented on the fact that those children with binaural hearing aids almost always seem to be able to perform better than those children with monaural aids. The same comment was true for the use of the binaural auditory trainers. Teachers reported increased awareness, more vocalization and better voice quality, and greater ease in correcting articulation errors with those students using binaural amplification.

CATEGORY II - EDUCATIONAL ENVIRONMENT

The next section of the questionnaire was directed toward Classroom Features, and was intended to answer some very specific questions about the accoustical environment in the classroom.

Table 6 - Accoustical Environment -- classrooms

	No. of Classrooms Reporting	
	Yes	No
a. Classroom is well insulated from outside noise	25	32
b. Classroom is well insulated from adjacent classroom noise	34	23
c. Classroom has acoustical tile on the ceiling	52	5
d. Classroom has carpeting on the floor	17	30

Over half of the classrooms reporting are not well insulated from outside noise. Slightly less than half reported that they are not well insulated from adjacent classroom noise. It is generally well known what minimum provisions for acoustical treatment are desired. It is obvious that many of the classrooms do not have adequate acoustical treatment.

The most common feature for the classrooms reported is the provision for acoustical tile on the ceiling. Almost all classrooms have this feature. Only about one third of the classrooms reported having carpeting on the floor. On a long term basis, carpeting is believed to be actually less expensive to maintain than other types of floor coverings.

When the teachers were asked to rate the acoustics of their classrooms, there was only one who replied with a rating of excellent. The rooms were rated as shown in Table 7.

Table 7 - Rating of classroom acoustics by teachers

Excellent	1
Good	19
Fair	15
Poor	21

In response to the request for opinions on what the teachers would consider as ideal in design for a classroom for deaf and hard of hearing, many reported "approval" of the specifications outlined in the publication A GUIDE TO THE EDUCATION OF THE DEAF IN THE PUBLIC SCHOOLS IN CALIFORNIA. They did not, however, limit their suggestions to this publication alone.

CATEGORY III - AUDITORY TRAINING EQUIPMENT

In this section the teachers were asked to report on the equipment they use, how they use it, and its value to them and the students. A wide variety of amplification equipment was reported by teachers; most older systems being the "group" type and newer ones being "desk top" type or "loop" type systems.

The age range of equipment reported ranges from "brand new" to 18 years old for a custom installation that is no longer used but is still in the classroom. Most of the equipment is relatively new, with the average age being about 3 years.

Another related question was whether or not the teachers used the equipment on all of their students. Below are a few of the comments of those 19 respondents reporting they did not use the equipment with all their students. (Some NO answers were without comment.) There were 39 teachers who replied that the equipment was used on all of their students.

1. Prefer children to use their own aids. The children object to the earphones.

2. Earphones are too tight. Prefer to use own aids.

3. Prefer to use their own aids.

4. Three do not use it. They are "slightly hard of hearing" and don't need to use the training unit or hearing aids.

5. Children do as well with their own aids and prefer using their own aids.

6. Only one does not use it. He is totally deaf. All others put them on when they come in and take them off when they go home.

7. Two do not use it. They are hard of hearing and have binaural aids. They are in class one hour a day for tutoring (integrated program).

8. Two are hard of hearing, and have good individual aids. All others use it daily.

9. None use it. They hate it. Head sets are impossible with teenagers. They and I prefer individual aids. (This unit is 18 years old and not used in last 5 years.)

10. Only one room equipped with new equipment. Other rooms have unusable systems. Will have all new equipment next year.

11. Equipment not working all the time. Most children have own aids and seem to prefer them.

When the teachers were asked how they became familiar with the equipment, only one reported that she had received some training in college on the various types of auditory training equipment. The majority reported that they were oriented to the equipment by the salesman. Others reported that they oriented themselves or were given some instruction by some other person. Table 8 gives these figures.

Table 8 - Did someone orient you to the equipment, or did you figure it out yourself?

Self oriented	17
By salesman	31
By other teacher	6
By principal	1
By other school official	8

Many of the respondents indicated by comments that they received excellent orientation by the salesman. There were many others who indicated they felt they had not received a satisfactory orientation by the salesman. In some cases orientation involved two separate long sessions, with time for actual demonstration in use and time for questions to be generated from one meeting to the next. In other cases, the respondents felt the need for further orientation by someone who had a greater knowledge of hearing losses and the needs of the teacher and students. In general, then, orientation to effective use of the equipment seems to leave room for improvement.

Almost half of the respondents reported that they were not supplied with a manual regarding the use of the equipment.

Slightly more than half of the teachers (33 out of 58) reported they felt they did have an adequate operating knowledge of the equipment. The remaining number felt there was much more they could learn about it. In general, those who answered that they had an adequate operating knowledge had nothing further to say. There were, however, several who went on to comment on reservations about operating the equipment. They expressed a need for more information and seemed to feel an inadequacy in relation to the equipment. Many expressed the need for more specific information in using the equipment with record players and tape recorded materials.

In contrast to the above, all of the teachers reported in the affirmative when asked if the equipment was easy to operate. Even though the equipment may be easy to operate, it is apparent from their comments that they do not feel at ease in operating the equipment.

Next in this section was a series of questions concerning the equipment and the children's and teachers' reactions to it in use.

The first question was - Is this equipment accepted by the students? There were 40 affirmative replies and 17 negative replies.

The importance of this question was the underlying and unstated question as to whether or not there was any significant relationship between the nonacceptance of the units, as judged by the teachers and the type of units used, or was the nonacceptance judgement based on a bad feature common to all units.

The primary and immediately apparent reason for most of the nonacceptance judgements is the fact that the earphones used are uncomfortable. Many of those teachers who reported acceptance of the equipment qualified their report of acceptance with comments on the problem of the wearability of the earphone. Thus, an auditory training system which may be ideal in terms of acoustic response, flexibility, durability of units and batteries, and perfect in all other respects may be totally inadequate because of unwearable earphones.

Next, we asked the teachers for a judgement as to which type of child seems to benefit most from the use of the equipment.

There were four respondents to this question who specifically stated that the profoundly deaf did not benefit from the use of the equipment. The majority of the respondents were in agreement that the profoundly deaf did benefit from the use of the equipment. The teachers felt that greatest benefit was to those children with the greater amount of residual hearing. In addition, some teachers observed that those children with their own monaural hearing aids seemed to benefit from and prefer the binaural headsets. Changes in speech behavior were more noticeable with these children. It was also a common remark by the teachers that children with binaural hearing aids seemed to do as well with them as with the binaural headsets of the training units.

In what area of your instructional program is this equipment most useful? For this question we listed ten separate categories and asked the teachers to rank five of them in order of importance. Most of the teachers commented that they were reluctant to attempt ranking any one area as more important than another. It was hard for them to decide and they did not enjoy the task. The importance of this is that the teachers felt that the auditory training equipment is useful in all aspects of the instructional program. They may have complaints about the equipment, and they may not be too sure how to use it for the greatest effectiveness, but they want it, they use it, and they want more and improved systems.

When asked if their auditory training equipment had any observable effect on the students, all of the teachers responded that the effects were obvious and encouraging. They were then asked to rank the following five areas in order of greatest observable effect, as shown in Table 9.

Table 9 - In what area does the use of the equipment have the greatest observable effect?

Category	Rank Order				
	1	2	3	4	5
Speech	33	7	2	0	0
Language	7	15	15	1	0
Social interaction	5	13	9	0	3
Other - "Attention getting" was the most often mentioned item in this category	0	1	5	13	0

Although speech was ranked as most important, many of the teachers specifically commented on the desirability of providing the students with instruments which made for greater ease of social interaction. With many of the units they reported the students could not hear each other very well if at all.

In comparing the performance of children on both individual aids and training units, the overwhelming majority (49) of the respondents reported better or the same performance when the children used the training units.

The consensus for those auditory training units judged as performing worse was that the children seemed to prefer their own aids instead of the earphones used with the training units. Two respondents reported their units as being too noisy.

In response to the question--Is the equipment more useful in group or individual training?--60% reported feeling it was equally useful in group or individual training; 30% reported feeling it was more useful in group training and 10% reported it was more useful in individual training.

Is the gain and power output of your equipment adequate for your students' needs? From those answering this question, the majority felt power for their units was adequate for their children. Fourteen judged them to be inadequate but for everyone of these there was at least another teacher who judged the equipment to be adequate for use with the same range of hearing loss, so that all things being equal, those judgements cancel each other. In general then, most of the units were considered to be adequate. There are, however, some individual children who evidently do not benefit from the units, regardless of make or power output.

What design improvements would you like to see in auditory training equipment from a teacher or therapy standpoint? From the design improvements mentioned in answer to this question, it is apparent that teachers do not like hard-wire units or equipment that requires the students to plug in phones before they can hear. The overwhelming majority of responses indicated the desirability of wireless systems. Twenty-two out of a total of 34 answers specifically mentioned wireless systems as the most desirable improvement. The second most frequently mentioned item was the need for microphone placement which would enable the children to hear themselves.

Third in order was the need for better design of earphones. The most often voiced complaint was that earphones were not wearable. Children complained, in some cases after wearing them 15 or 20 minutes of discomfort from the headphones. Next in line was the desire for smaller, lighter weight equipment that could be worn with greater ease, and with straps or harnesses that would stand up to wear and tear.

Mentioned less frequently, but with no less urgency, were the following problems: Feedback, "radio interference", and general noise in and around the classrooms. Also made known was the desirability of having more control over the frequency response and power output settings and of greater flexibility in frequency response settings.

It is difficult in listening to any amplifying system to make a determination of distortion present in the system. Unless the distortion, of whatever kind,be it either second harmonic, third harmonic, or transient, etc. is actually very high, it is not possible for most untrained listeners to detect its presence. In most cases distortion can best be demonstrated by acoustical measuring equipment. Despite the difficulty of this type of judgement, we asked the teachers to respond to the following question---To your knowledge, does the equipment distort at 1) low gain levels, 2) moderate gain levels, or 3) high gain levels. Table 10 below indicates that distortion was judged to be present by the majority of respondents when the system was at high gain levels. Only three judged distortion to be present at low gain levels.

Table 10 - Number judging presence of distortion at low, moderate, and high gain levels.

	YES	NO
Low gain levels	3	50
Moderate gain levels	4	49
High gain levels	32	18

CATEGORY IV - MAINTENANCE

The fourth category was devoted to questions regarding maintenance, durability, and replacement of the auditory training systems. The first question we asked was--Does the equipment seem to hold up well under general use? In response, 30 answered yes while 7 answered no. The following are edited responses of those who reported that the equipment did not seem to hold up well under general use.

Table 11 - Problems of durability with specific equipment

"15 headsets have been repaired three times each. The units seem to need too frequent charging. The batteries discharge rapidly and the units get dirty and grimy."

No comment.

"Six months after we got them, about half of them needed some repair." (Repairs needed were unspecified.)

Salesman has had to replace or repair various defective parts. Our school maintenance has done a good job with some other repairs.

We have had very poor service in the past on repairs.

The need for repairs increases as they get more use, and repairs are difficult to get.

They do not hold up well on OUR pre-schoolers.

The most frequently mentioned repair need was for broken cords, wires, etc. and for excessive battery replacements. The following poll was taken concerning maintenance:

	YES	NO
1. Does the equipment get regular periodic checks?	16	17
2. Is this your responsibility?	22	11
3. Is this someone else's responsibility?	15	16
	Frequent	**Infrequent**
4. What has been your experience with respect to frequency of repair of your equipment?	9	17

Table 12 - How often is old equipment replaced with new?

Number responding who indicated a definite policy.	Total
Every 3 years	1
Every 5-6 years	2
Every 10 years	3
As often as necessary	3
As often as money allows	2
	11

Number responding who indicated no definite policy or did not know of definite policy.	Total
"Don't know, or no set policy"	12
"Never"	3
"When it falls apart"	2
	17

There is an obvious need for definite repair and replacement policies. This is essential to every program, and of prime importance is the assignment of responsibility to see that the policy is carried out. The equipment is useless, and worse, it is detrimental to the students if it is not maintained and checked periodically to insure that it is operating properly. Every teacher should be able to look for and identify minor and major problems. Minor problems normally can be handled by the teacher. Major problems requiring technician repair should be reported immediately; the equipment repair technician should appear immediately; and the repairs should be made immediately. The key is a definite and well understood policy and procedure for repair and maintenance. A maintenance and repair contract with a reliable firm should solve many of the problems evidenced by the answers in Table 17.

In summary, it can be stated without reservation that revitalized and dynamic approaches are urgently needed to upgrade the quality of programs for deaf and severely hard of hearing in our state. Critical study of our most important instructional "tool", educational amplification, and how it is used is warranted in a total effort to improve the education of deaf and severely hard of hearing children in California.

Luncheon address to the E.A.R.S. Workshop August 2, 1968 by
Mr. Hyman Goldberg - Chairman, Hearing Aid Research Committee of H.A.I.C.,
Hearing Aid Industry Conference.

"A Consideration of Educational Amplification Systems and Standards"

Educational amplification systems, of many different varieties, have been in use for at least the past thirty years. It becomes increasingly obvious that a classification of all existing systems as to their effectiveness in the teaching and learning situations should be undertaken.

All educational amplification systems (E.A.S.) are used for communication purposes and therefore have much in common, such as they all amplify sound. In order to do this, they must all have their own frequency response, maximum power, and distortion characteristics. These must be evaluated as to their effectiveness in a teaching and learning situation. All systems must be looked at from the viewpoint of usability such as the mobility of teacher and students. The size and weight of the equipment with which the participants must be encumbered is also of very great concern, especially with younger students.

There are five basic available systems.

a) the hard wire system
b) the audio induction loop
c) the radio frequency (R.F.) induction loop
d) the radio frequency (R.F.) free field system
e) the self-contained portable unit

The hard wire system has the honor of being one of the first to be put into general use. This system basically consists of an audio power amplifier and many earphones with individual volume controls connected to it. The teacher usually uses a lavalier microphone which hangs around her neck. For intensive speech training, the teacher would speak directly into the microphone while holding it in her hand. The hard wire E.A.S. is still the most prominent one in use today.

The self-contained unit was an attempt to provide the student with greater flexibility within the school; it consists of a small unit which the student may place on his desktop or hand carry. The unit may have one or two microphones which are built into the unit. The student wears either muff or insert receivers connected by a cable to the unit.

Approximately five years ago, the audio induction loop system was introduced. This basically consisted of a wire placed around the classroom and the audio signal from an electronic amplifier fed into the loop. The current of electricity flowing through the wire surrounding the room induces a magnetic field within the room. The students use the telephone pick-up position on their hearing aids to pick up the magnetic signals which are then converted into sound by their hearing aid receiver. This system has two major features which distinguished it from the hard wire auditory trainers. The first and foremost is the freedom of movement within the enclosed loop that the student has, and the second is that most of the students can use their own hearing aids within the system. The audio loop system also creates a major difficulty as spillover is prevalent between adjacent rooms situated either horizontally or vertically.

In order to overcome this situation a third system, which is based upon Radio Frequency Selectivity, was developed. This auditory training system consists of a radio frequency generator, amplitude or F.M. modulated fed into the same loop surrounding the teaching area. One could then have a multitude of closely situated classrooms with each one operating at a different carrier frequency and the students hearing devices tuned to the frequency of the classroom they were in. This solved the problem of spill-over between adjacent rooms but created an additional problem, the need for having sophisticated receiving devices that the students have to wear. Their hearing aids no longer functioned within the RF Auditory Training System. One must observe that all of the foregoing systems are confined to use only in the classrooms they were installed in.

Approximately within the last two years, a new free field non-confining RF system was developed. This free field system consists of a battery operated RF transmitter worn by the teacher, that allows complete freedom of motion; and battery operated receivers for the student that allows complete freedom of motion. The teachers could now take their students into any area, inside the building or outside, and still have a communication link.

In all of these auditory training systems,communication is the object, therefore all measurements that describe their basic ability to perform satisfactorily under all possible available conditions, should be made. Many of these measurements are common to all systems and the results of these can be directly compared and evaluated.

Each system must be capable of supplying the necessary acoustic output levels that will satisfy the most profoundly deaf student. The use of a General Radio Sound Level Meter and a 2 or 6 cc coupler will indicate the maximum acoustic energy delivered from a hearing aid receiver or a head phone. The same equipment with the addition of a variable frequency oscillator can be used to plot the overall frequency responses. It should be recognized that the frequency response should be primarily a function of the receiving devices. The transmitter or amplifier should always have a pre-selected frequency characteristic. It is obvious that changing the response characteristics of the transmitter or amplifier will change the frequency responses for all the students. Each receiver should be capable of providing, in conjunction with the transmitter or amplifier, the proper frequency characteristic for the individual student.

The overall distortion of the total system is composed of the distortion contributed by the transmitter or amplifier and the distortion of the receiver. The transmitted distortion should be minimal so that the total distortion of the system could be kept within acceptable standards. With the addition of a distortion meter, accurate distortion measurements can be made. The measurements of power, frequency, and distortion are common to all systems. The need to make these measurements becomes obvious when one analyzes the implications. For instance, the measurement of acoustic output will inform the teacher which of the students can function effectively within the system. It again becomes obvious that a student who needs a greater acoustic output than the system can provide won't be capable of functioning. His rate of learning would be nil. The same situation would occur if the frequency response of the system couldn't supply sufficient information to the student. If the total system supplies excessive distortion to a student then again his ability to function in the system will be impaired. It must be understood that when speaking of the system we mean the transmitter and the individual student receivers. If there are ten students using ten receivers and one transmitter, we have ten acoustically different systems that will give us ten different power, frequency and distortion measurements. It is always best, if one wants to make meaningful measurement with any system, to use a standard receiver that produces a minimum of distortion and a maximum flat frequency response. This will allow you to obtain an accurate measurement of the transmitting apparatus under investigation.

All systems that radiate free energy whether in a confining loop or from a non-confining radiator must be measured for field strength and intensity variations in the reception area. Electrical noise levels and spillover between adjacent rooms must also be investigated. The field strengths of the audio and RF loop systems can be measured with a "Magnetic Field Strength Meter." The field strength of a non-confining free field radiator must be known because it is easy to exceed the limitations set by the Federal Communications Commission. Field strengths in loop and free field systems are not uniform within the communications area and it is important to know where dead spots and weaker fields exist. The same holds true for free field radiators. Spillover is basic to all radiating systems and must be investigated as to the degree of interference induced in all other teaching areas in the building. Usually the adjacent areas will be most affected. This effect can be investigated with the "Magnetic Field Strength Meter" in loop systems and a "RF Field Strength Meter" in the free field system. The same equipment can be used to locate excessive noise interference in both systems. Field strength measurements are essential in order for the investigator to qualify all radiation types of E.A.S.

Of prime interest is the degree of maintenance necessary to keep a system in good operating condition. The system can be divided into two distinct factors namely the transmitter, including its associated wiring, and the receivers. In those systems that standard manufactured hearing aids are used as receivers, the maintenance of the hearing aids are usually serviced by trained representatives of the manufacturer. The reliability of these hearing aids has long been established. Receivers that will function only in one particular system should be thoroughly checked for cost of operation, reliability, and ease of maintainability. Any auditory training system is only as reliable as the weakest link in the system.

If your description of the term maintainability would be the ease of servicing and repairing equipment to its original condition, this would presuppose that the equipment will fail. A fair description of reliability would be the amount of failures of a given amount of units over a specified amount of time. From this we can deduce that if a piece of equipment never fails then the maintainability problem becomes zero. It becomes obvious, therefore, that a high reliability factor will produce no breakdowns or a limited amount of breakdowns and the ease of maintainability then is not considered a factor; for example, if the reliability factor of a piece of equipment was one part in 1000. If the reliability factor is 100 parts in 1000, you then would have a maintainability problem. In the first case you would not care if he had to enter into the piece of equipment for repair purposes. In the second case, we would have to make sure that we could gain access to the circuit and working parts of the equipment for repair because of the low order of reliability.

It becomes obvious that the reliability of equipment is of prime importance when considering the purchase of a piece of equipment.

In summation, the value of any E.A.S. can be measured only through the establishment of standards of performance. The parameters of acoustic output level, frequency response, distortion, field strength, noise levels, spillover, and degree of maintenance must be adequately defined before the E.A.S. user can properly evaluate any system.

Luncheon address to the E.A.R.S. Workshop August 2, 1968 by
Mr. Richard S. Campbell - Manager of Quality Assurance Convair
General Dynamics San Diego, California

When I was first asked to speak at your luncheon today, I thought that you might be interested in quality assurance in the electronics industry. However, as the workshop began to take shape and I read the agenda and questionnaires, and started reviewing some of the equipment under study, a different idea began taking shape in my mind and so I would like to talk to you briefly on Quality Assistance for Hearing Handicapped.

I chose that title because we all agree that Hearing Handicapped need assistance and we are the ones who are in a unique position to insure or improve upon the quality of such assistance. Quality Assistance for the Hearing Handicapped refers to a team effort. For the purpose of definition, the team is the Teacher, the Audiologist, the Equipment and the Pupil.

Now in the case of the Teacher, he or she is obviously qualified, calibrated and dedicated to the task at hand. If she were not, she would not be teaching hearing handicapped, as instruction with poor communication between the teacher and the student is difficult at best. If you had not wished to be teachers you would have chosen an easier field.

We now consider the Pupil. The Pupil comes to us with certain things that are fixed. For example, he comes to us with certain innate intelligence - which we cannot alter. He comes to us with a certain frame of mind which we may alter a bit from time to time, but is generally controlled mostly by his home environment. We hope he comes to us with a full stomach, but if not there are generally programs we can actively pursue to see that he is adequately fed. We hope he has reasonable health so that he may concentrate on our joint venture of teaching him. He definitely has a hearing loss which we generally cannot alter.

The third part of the team is the Equipment. It is this "tool" with which this workshop is concerned. You people together with perhaps an idea or two that I may give you will make recommendations that will help others select the best equipment for their particular needs. We are interested in quality of performance, ease of operation, expected reliability, failure modes and effects, ease of maintainability, and need for daily check.

Our first point, quality of performance, relates to the performance profiles that have already been discussed with you. This relates to adequate volume, adequate fidelity, frequency range, distortion, etc. If you have the best piece of equipment from the standpoint of acoustic performance, we must next consider its reliability. In other words, will it continue to perform and give the superior results that caused it to be selected in the first place. If not, then maybe we need to alter our selection with stronger emphasis in the field of reliability. We need also to consider the rigorous environment of children. In other words, you will note from the evaluation sheets that we have considered such points as, will the case stand up or will it shatter? Will the case on the other hand protect the individual components mounted inside? Having considered these things we need to look to failure modes and what are its effects. Does it collapse when it ceases to operate? Does anyone around know that it is not operating or does it insidiously deviate from good operation? As an example, in the aerospace industry, we have a very elaborate calibration and recall system for test equipment. If we could buy a meter that would work perfectly to a point and then turn purple, we would never call this meter in until it turned purple. The thing we are concerned with the most is the meter that appears to be doing an outstanding job but which is actually giving false results.

The most definitive standard that we have in the electronics industry is the NASA Specification NOC 200-4, "Quality Requirements For and Soldering of Electronic Components". This specification is extremely rigid and though lesser solder techniques might give adequate results, we are convinced that soldering following this specification will give the minimum of "in service" problems. The other elements, such as reliability, maintainability, serviceability, etc. are based on approximately 25 years experience and generally are in accordance with MIL-E-5400, "Electronic Equipment, Aircraft General Specifications". Elements not covered by these two specifications are based on many years of experience and many types of failures in electronics.

The next consideration is maintainability. Must the system we select be returned to the factory or can it be repaired by a local Radio or TV technician with a minimum of special equipment? Do we need special equipment, special schematics? Maybe we should consider at the time of procurement of equipment entering into a service contract with some local organization so that they will be prepared in advance of need. At this point I may sound somewhat like a mortician. What I am driving at is - have some local service organization set up with the equipment, schematics, parts list and know how to repair this device when it needs repairing, not wait until we have one less unit than children then proceed to get someone to fix it. Another consideration might be - Is special repair equipment supplied with the system or must it be purchased? Some of the equipment under evaluation is Japanese manufactured. Now the Japanese do an outstanding job in the field of electronics, however, if you live in Podunk Holler, sending it to Japan is not the way to keep the training program going. If you select Japanese manufactured equipment, you should have a conversion list of what American parts will provide a suitable replacement.

I briefly touched on calibration on our failure modes. I would like to say that equipment manufacturers should provide some method by which the teacher can make a daily check on each set to be used or on any set suspected during the teaching day. Ideally the system should have equipment or techniques that would give quantitative measurement of the performance of that equipment. There is no reason why any of the manufacturers could not design such a self check in their system and let you start the day confident that each child is hearing as well as he could with that kind of equipment.

In conclusion, I am very proud that our local San Diego Speech and Hearing Center was selected to participate in the E.A.R.S. study, and feel that it is an excellent opportunity to help teacher and administrators in the selection of equipment that is suited for their needs without their depending entirely on a salesman's pitch. I hope that I have given you some ideas that may beneficially assist in assuring a complete and efficient team effort.

DEFINITIONS

DEFINITIONS

Acoustic Gain is usually considered as the number of dB a particular signal is amplified. In other words, gain is the difference in dB between the input and the output of a particular system. In that gain generally varies with frequency, a method of reporting this function has been established by HAIC (Hearing Aid Industry Conference) and is accomplished as follows:

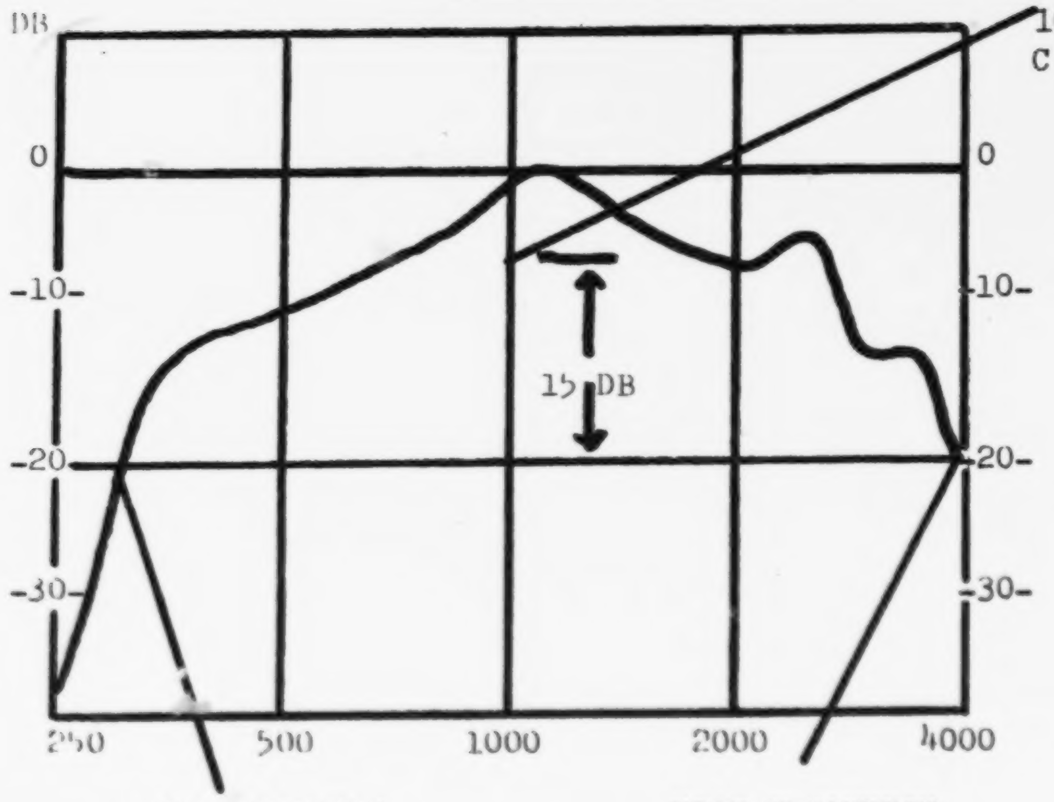
In the hearing aid the gain control is set at its maximum position and 50 decibels of sound pressure is applied to the microphone through a wide frequency spectrum, with the output sound pressure measured specifically at each of the test frequencies of 500, 1000, and 2000 cycles per second. The 50 dB of input is then subtracted from the output measurements at the selected test frequencies. The values obtained in this manner are then averaged to obtain the "H.A.I.C. Average Gain".

Acoustic Output is defined as the maximum deliverable output that an instrument is capable of producing. This is usually accomplished by presenting a signal of sufficient intensity so that the instrument under test is driven to its maximum or saturation output. This function is generally accomplished as follows:

In the hearing aid the gain control is set at its maximum position and a sufficient sound pressure is applied to the microphone so as to drive the hearing aid to maximum output at each of the test frequencies of 500, 1000, and 2000 cycles per second. The measured sound pressure levels at the selected frequencies are then averaged to obtain "H.A.I.C. Average Output".

The basic response curve of the instrument is made according to the method prescribed by the American Standards Association. The "H.A.I.C. Average" of the gain values at 500, 1000, and 2000 cycles per second (as read from the basic response curve) is plotted on the 1000-cycle ordinate. A second point is plotted on the same 1000-cycle ordinate 15 decibels below the first point. Through this second point, a straight line is drawn parallel to the frequency axis (the base line). The low frequency limit of range is the point at which this straight line intersects the response curve in the direction of decreasing frequency, and the high frequency limit is the point where the line intersects the response curve in the direction of increasing frequency. See illustration below:

FREQUENCY RESPONSE CURVE



Average of 500,
1000 and 2000
C.P.S. values

LOW FREQUENCY
LIMIT

HIGH FREQUENCY
LIMIT

Frequency Response Uniformity is revealed in the deviations of the frequency response curve, i.e., the peaks and valleys. The higher the peaks and the lower the valleys, the greater the non-uniformity. In hearing aids we have learned that the greater the deviation, the greater is the chance for poor hearing and also acoustic feedback. The acoustic feedback will be generated by the peaks when the user attempts to increase the gain of other frequencies he wishes to hear. This limits his effective use of the gain. In that there are no published guidelines regarding this phenomenon, we have had to rely upon our experience with hearing aids and thus establish our own scale of suitability. For the purpose of this evaluation we will look at the frequency range of 100 Hz to 5000 Hz when the large type earphones are used, such as the TDH 39, and a frequency range of 200 Hz to 4000 Hz for the insert (hearing aid) type earphones with an input of 50 or 60 dB. Following is the method of rating established for this study:

Deviations within +3 dB	excellent
One deviation of up to 5 dB	excellent
Two deviations of up to 5 db	good
One deviation of up to 10 dB	good
Two deviations of up to 10 dB	fair
Two deviations of up to 5 dB; one deviation up to 10 dB	fair
One deviation of up to 15 dB	fair
Three or more deviations of up to 10 dB	poor
Two or more deviations of up to 15 dB	poor
Any deviation over 15 dB	poor
Other deviations will be rated in a similar fashion.	

Harmonic Distortion, simply stated, are those sounds that were generated by the system as a result of the input signal, but which were not a part of the original input signal. These unwanted sounds are generally heard as harmonics of the fundamental frequency. Our interest in this study is directed only toward the second and third harmonics as they appear in the frequency range of 250 Hz to 4000 Hz. In other words, instead of looking at total harmonic distortion at specific frequencies we are looking at harmonic distortion as it appears anywhere within the above described range. The scale used to establish percent distortion may be found in the Appendix. Following is the method of rating established for this study:

Up to 5% distortion	excellent
5 to 10%	good*
10 to 15%	fair
over 15%	poor

*Note: The Audiology department of the San Diego Speech and Hearing Center rejects any hearing aid that exceeds 10% distortion.

In an auditory training device where the frequency response may be broader than that found in a hearing aid, a more rigid criteria of rating than that shown above should be applied.

Tone Control Variability: It was the feeling of the study committee that if a tone control is made a part of the auditory training system, it should exert a significant change in frequency response. It was decided that a step type control should exert at least a 3 dB per octave change per step. A continuous type control should exert at least a 6 dB per octave change from zero to maximum rotation.

If these criteria are not met to within 2dB the rating was considered to be poor. If these criteria were met to within 2 dB but less than 1 dB the rating was judged as fair. If these criteria were met to within 1 dB the rating was good. If in the continuous control these criteria are exceeded the rating was considered as being excellent.

Uniformity between channels is concerned with the ability of the two earphones of a system to put out the same sound. Our experience in working with classroom teachers is that they expect, and rightfully so, that the two earphones of a system put out the same sounds, i.e. what is produced by one earphone should also be produced by the contra lateral earphone unless internally or externally the instrument has been adjusted to do otherwise. It was impossible, due to the time limits imposed on this study to perform gain control taper curves on those instruments that provided separate controls for each channel. On instruments with separate controls for each channel or earphone, we arbitrarily selected similar settings and then tested for uniformity. In the case of a single control we were then only interested in uniformity between earphones and the gain was therefore usually set at maximum for the test. Following is our established rating criteria for uniformity between channels and/or earphones:

Response within 2 dB from 100 to 5000 Hz	excellent
Response within 2 to 5 dB from 100 to 5000 Hz	good
Response within 5 to 8 dB from 100 to 5000 Hz	fair
Response deviations greater than 8 dB from 100 to 5000 HZ	poor

Control Calibration-Gain, Power Output and Tone: Several manufacturers have attempted to calibrate the various function dials. This is a desireable feature but one that should be done with a fair degree of precision. In general the following criteria was used in ranking these functions:

Within ± 2 dB	excellent
Within ± 3 to 5 dB	good
Within ± 5 to 10 dB	fair
Greater than 10 dB	poor

Compression Attack and Recovery Time: Several manufacturers have chosen to use compression amplification rather than peak clipping as a means of limiting the maximum power output. In peak clipping, the engineer **merely** allows the amplifier to saturate at some pre-determined level. When an amplifier saturates, a resultant peak clipping of the signal occurs and certain harmonics are added to the signal that were not there to begin with. Whether it be odd and even harmonic distortion or just odd harmonic distortion, the result is nearly the same, that is, unwanted sound. In an effort to guard against this peak clipping at low input levels, the engineer will usually design the instrument to have a maximum power output which is at least 65 dB and preferably 70 dB above the maximum gain of the instrument. In this way normal conversation will not cause the system to saturate. In the event that the teacher is to wear a lavalier microphone, the engineer must design the instrument for even greater separation between the gain and power output. In this case he must either sacrifice gain or provide a power output which is much too high.

In compression amplification, we are not bound to these design limitations because we do not limit the output by clipping the signal. In this case we limit the output through the use of a built-in Automatic Volume Control (AVC). With an Automatic Volume Control a sensing circuit within the system determines when a sound is exceeding a particular predetermined intensity level. The circuit then quickly causes a volume change to occur. This happens usually, without any distortion occurring in the resultant signal at the listener's ear. A good illustration of AVC is when one is listening to a football game over radio or T.V. When the announcer is not speaking the crowd noise is louder. The loudest sound impressed on a system with AVC causes weaker sounds to be made weaker by the same amount that the loud sound is reduced in volume.

One of the artifacts of compression amplification is the resultant attack and recovery time, i.e., the time it takes for the AVC circuit to react to changes in intensity. When a loud sound is suddenly impressed upon the system it takes a certain amount of time for the AVC circuit to react. In the mean time, the resultant output of the system may be as high as though there were no AVC working. In this case if a sudden 20 dB change in intensity occurs and the resultant AVC action is to allow only a 5 dB change in intensity, the period of time between the onset of the signal and the time the AVC controls the signal is a crucial time. During this time the output can swing the full 20 dB with a resultant discomfort being experienced by the listener. Another phenomenon of this circuit design is that the change in intensity from soft to loud can be attacked fast enough so as not to cause physical discomfort but not fast enough to keep from causing long range listening fatigue. Another factor relating to attack time is the undershoot which follows the overshoot. During this time the signal may be too low for the listener to hear.

The recovery time in compression amplification is the time it takes for the system to recover from a loud to soft change in intensity. The undershoot on recovery is somewhat like the undershoot on the attack sequence, it can result in so-called blackouts of sound.

All these undesireable phenomena can be avoided if the AVC circuit works fast enough. The fastest attack and recovery times we have thus far seen in hearing aids is 10 milliseconds for attack and 40 milliseconds for recovery. This is admittedly fast, however, it has been achieved in instrumentation much smaller than that found in the usual auditory training system. We therefore feel that it is possible to achieve this in those auditory training systems using this method of limiting.

In looking at the few systems demonstrating this method of limiting we took into consideration the speed with which the AVC circuit reacted and also the amount of overshoot and undershoot that took place. In general, we accepted as being excellent a system which attacked the signal in 50 milliseconds and recovered in 150 milliseconds; however, we would like to see this improved upon. Anything beyond 100 milliseconds for attack and 500 milliseconds for recovery was considered poor. However, if the recovery was long,over 500 milliseconds, but the dB change small, i.e. 2 to 3 dB, the rating was increased to good.

Oscilloscope tracings will be found included with the acoustic data on those instruments exhibiting compression amplifications. A study of these tracings should help one to understand the action of such a circuit.

THE STUDY

In this study, nine different makes of auditory training systems and twenty-seven different models were subjected to an acoustical, quality control, and educational analysis. In that auditory training equipment is not too dissimilar to hearing aids, except in size, we felt that test methods and equipment as used in the hearing aid industry would be appropriate to this study.

TEST EQUIPMENT

Equipment utilized in the acoustical analysis consisted of a Bruel and Kjaer hearing aid evaluation system which was made up of a B & K type 4212 test chamber, a type 1024 Sine-Random Generator, a type 2112 Audio Frequency Spectrometer. a type 2604 Microphone Amplifier, and a type 2305 Level Recorder. Standard 2cc and 6cc couplers were used for measuring the pressure responses of the insert type earphones and the TDH 39 earphones with MX-41/AR cushions. For measuring the response of earphones incorporating the full muff, we used a B 7 K Artificial Ear type 4153 which makes possible the use of a flat plate coupler. Calibration of the above system was maintained through the use of a B & K type 4220 piston phone and the built-in internal calibration procedures.

To further reduce the chance of sound pick-up, low frequency rumble and other artifacts, the B & K type 4212 test chamber and the artificial ears were placed inside of an IAC model 400 sound chamber.

To record attack and recovery times of compression amplifiers, the above system was used in conjunction with a Tektronix model RM 564 storage Oscilloscope using a type 3A3 vertical amplifier and a type 3B4 time base. To trigger the system, a custom made Zenith transient trigger was used. Photography of the resultant attack and recovery action was accomplished with a Tektronix Oscilloscope camera type C-27.

A block diagram and picture of this test set up can be seen in Figure 1 and Figure 2.

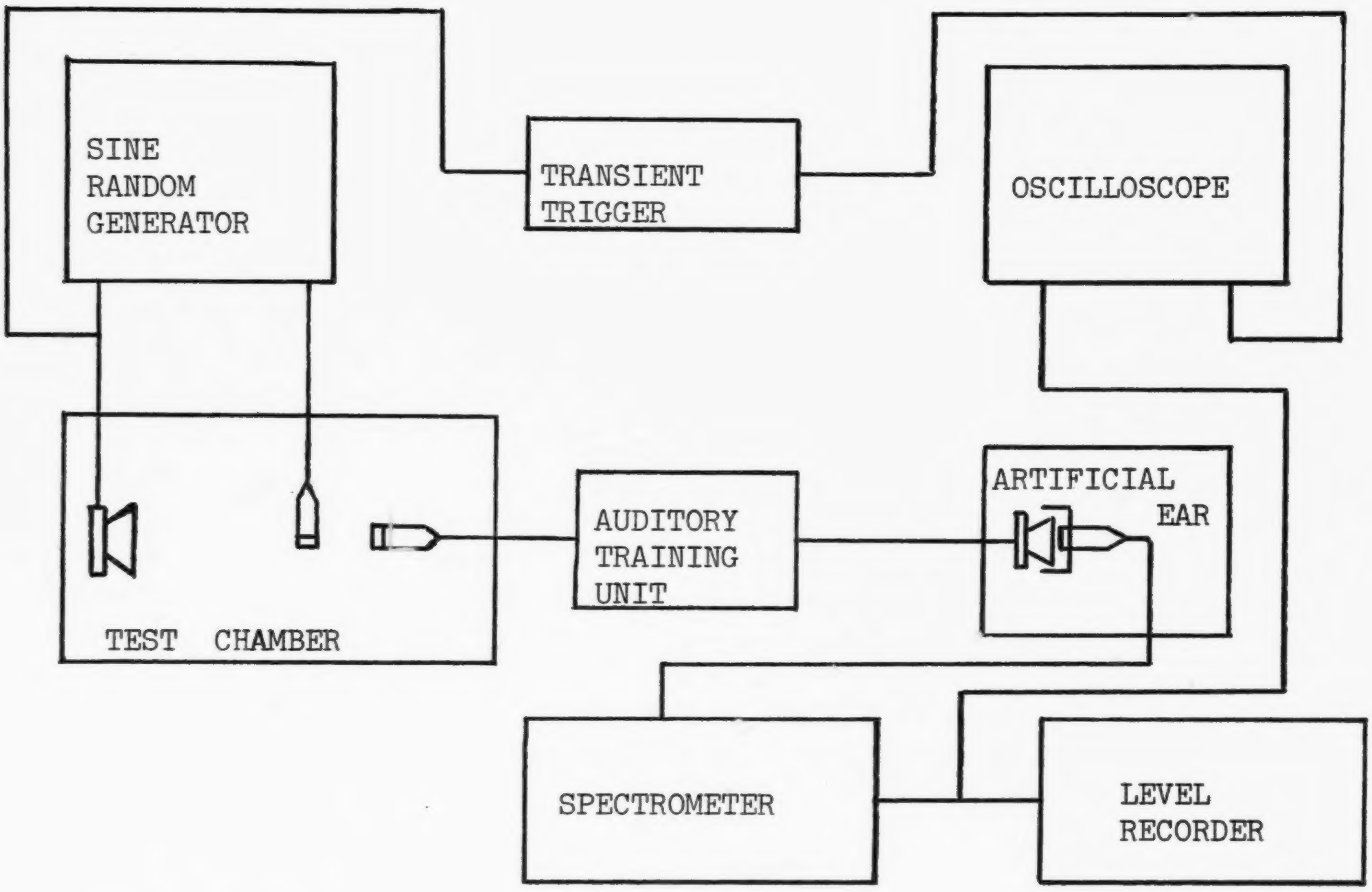
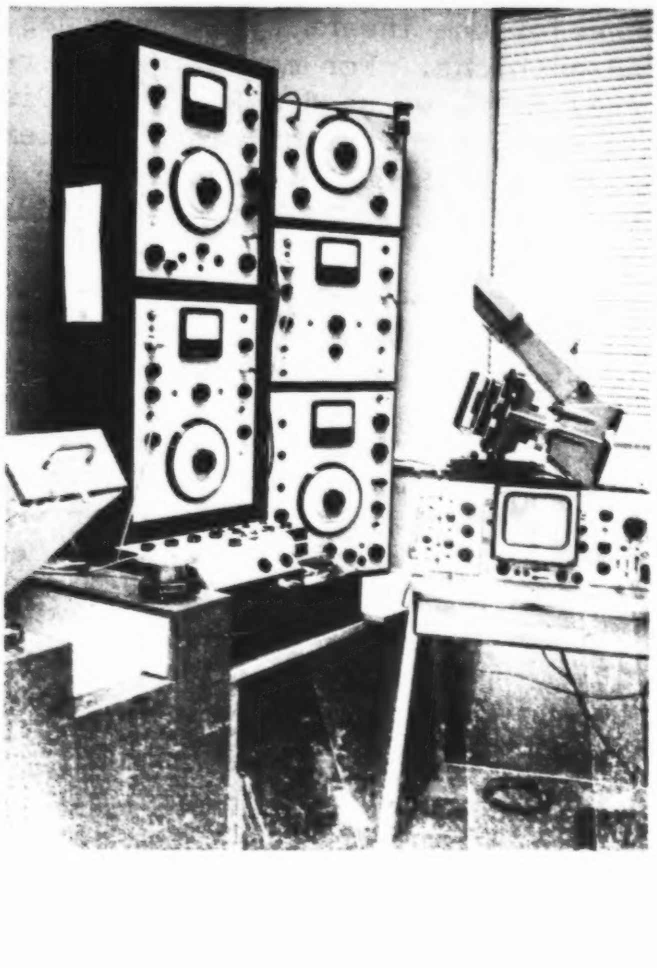

SINE
RANDOM
GENERATOR
TRANSIENT
TRIGGER
OSCILLOSCOPE
TEST CHAMBER
AUDITORY
TRAINING
UNIT
ARTIFICIAL
EAR
SPECTROMETER
LEVEL
RECORDER

Figure 1



PROCEDURES

The experimental procedure concerning the acoustical evaluation of this investigation involved a range of different tests. The primary test, conducted on all Auditory Trainer circuits, was a series of curves performed at different input levels. In this way we determined the gain, frequency range and Maximum Power Output (MPO) of each unit. To accomplish this the instrument under test was set at maximum gain, and inputs of from 50 or 60 dB to 90 or 100 dB were presented. All curves were recorded on the same chart so that changes in output could be compared.

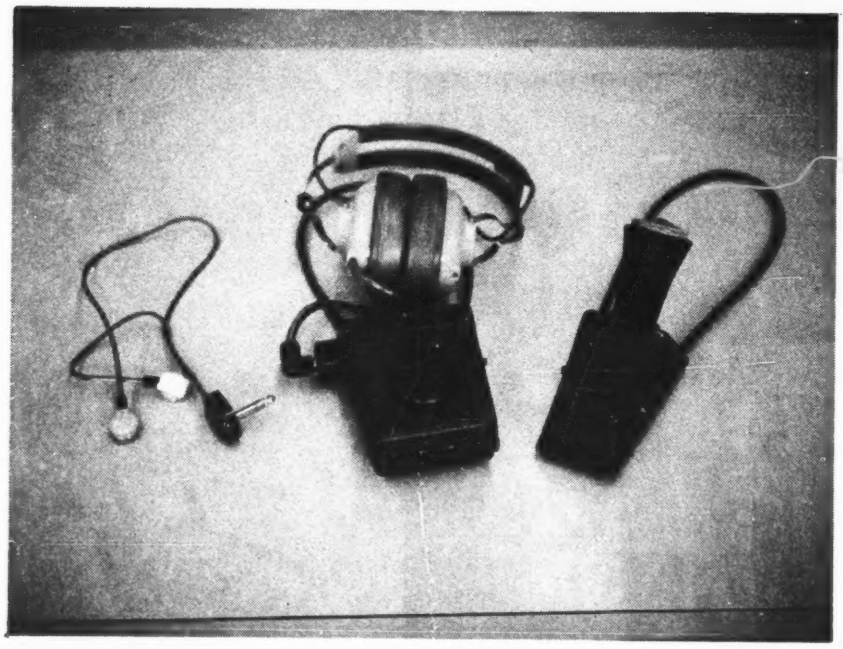
The second test for most systems was a test of harmonic distortion. (Refer to Definition Section of this report.) In cases where distortion was less than 5%, a graph was not included with this report. This test was performed by first reducing the gain of the instrument under test by 5 dB below maximum. A 70 dB input throughout the effective frequency range was then applied and the resultant harmonic distortion recorded. The second harmonic was found to be the dominant harmonic in most cases with the third harmonic too low to be recorded. In one case, however, we found that the third harmonic was the dominant harmonic. A scale relating to harmonic distortion will be found in the Appendix Section.

All other acoustic comparisons were usually conducted at full gain settings with inputs of 50 or 60 dB.

In analyzing the compression features of an Auditory Trainer unit, we generally set the gain at maximum or at a level prescribed by the manufacturer as not to be exceeded. Power output, where applicable, was also adjusted to manufacturer's recommendations or at a low output setting. In that it was not practical to perform this test at all frequencies, we settled on 1000 Hz for the test frequency. 1000 Hz was thus applied at alternate levels of 60 dB and 80 dB. A level change from 60 to 80 dB would excite the attack sequence. A level change from 80 to 60 dB would excite the recovery sequence. A photographic record of this process is included with the respective instruments.

AMPLIFICATION SYSTEMS AND INSTRUMENTS EVALUATED

ACOUSTA

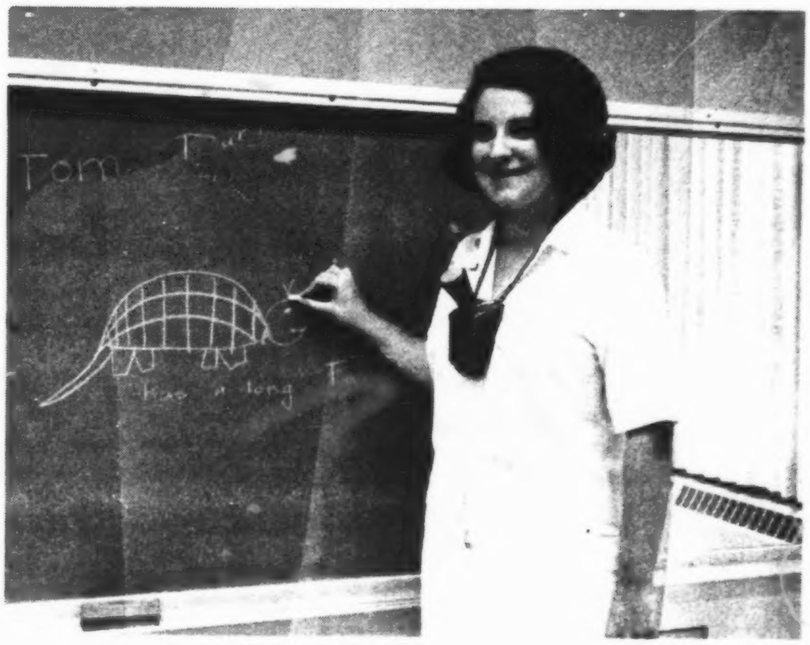


AUDITORY TRAINER, CONTROL, AND RECEIVER

WT-10 and WR-10

ACOUSTA

WT-10 and WR-10



Tom
has a long

ACOUSTICAL RESPONSE

ACOUSTA

Frequency response uniformity, represented by the 60 dB curve in Figure 1, shows two deviations of 10 or more dB and one deviation of 5 dB, occuring at 300 to 400 Hz, 600 Hz, and at 4000 Hz. This would receive a poor rating as per our criteria under definitions. In running the contra-lateral earphone, we did not see as many non-uniformities, Figure 4; however,the sharp drop off after 2000 Hz still cannot be considered as desirable. An overall rating of fair was given in this case. The insert earphone shows one sharp drop off after 1000 Hz which is certainly not desirable (see Figure 8). However, our rating scale would still rate the response as fair.

Harmonic distortion was run in this case at 80 dB because of the proximity of the teachers mouth to the mike. Distortion at its highest point, at 600 Hz, registered only 4.5% giving the system a harmonic distortion rating of very low which is an excellent rating. Harmonic distortion of the student unit only was found to be 8% at its highest point at 800 Hz which dictates a rating of low which is considered as being good rating.

Tone control variability is only effective when the teacher unit is broadcasting to the student unit. The student unit used as a hearing aid has no tone control adjustment. Tone control is accomplished by a 3-position control which meets the highest rating for a step control.

Uniformity between channels is considered to be fair as deviations of 5 to 10 dB occur in the range of 300 Hz to 550 Hz.

Gain and earphone output controls are not available to adjustment by the student.

A rather high noise level was noticed in some of the instruments we tested and at times a local FM station could be picked up.

The manual refers to the fact that the insert earphones can be burned out if the controls are set too high. We would consider this a bad feature and one which should be rectified.

ACOUSTICAL SUMMARY

ACOUSTA

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
trainer control and receiver	40	175 - 3300	121
receiver only	37	250 - 3400	124

ACOUSTA

Note: Teacher unit WT-10 broadcasting to student unit WR-10. Muff type earphones (AH-1) used except where noted.

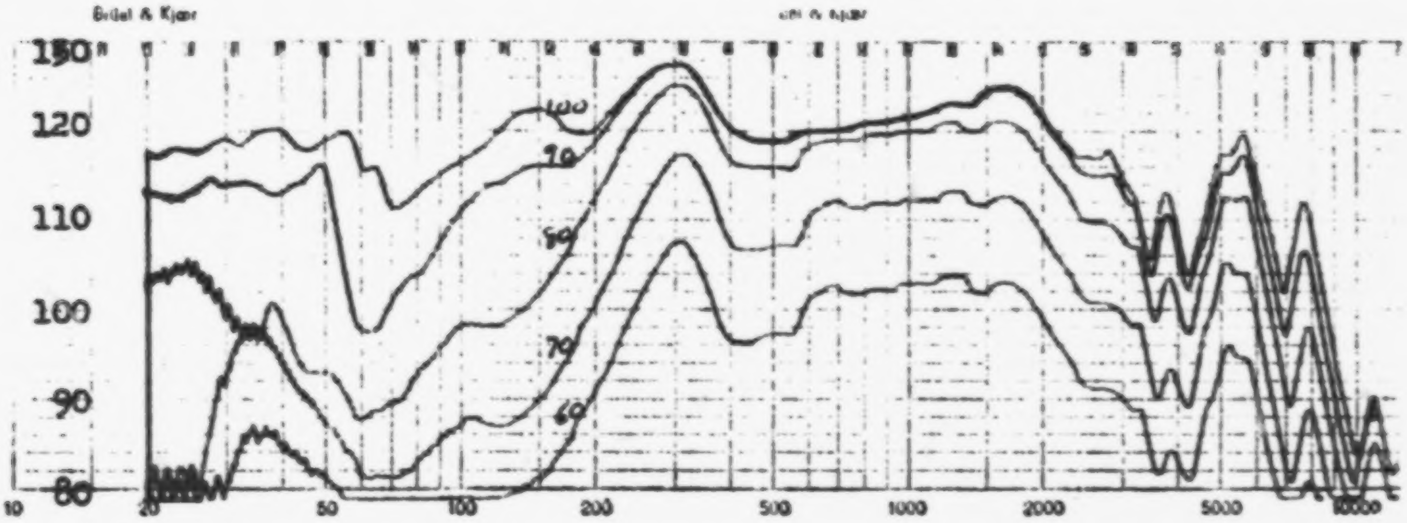


Figure 1 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB. Earphone balance control set at maximum. Receiver control set at maximum.

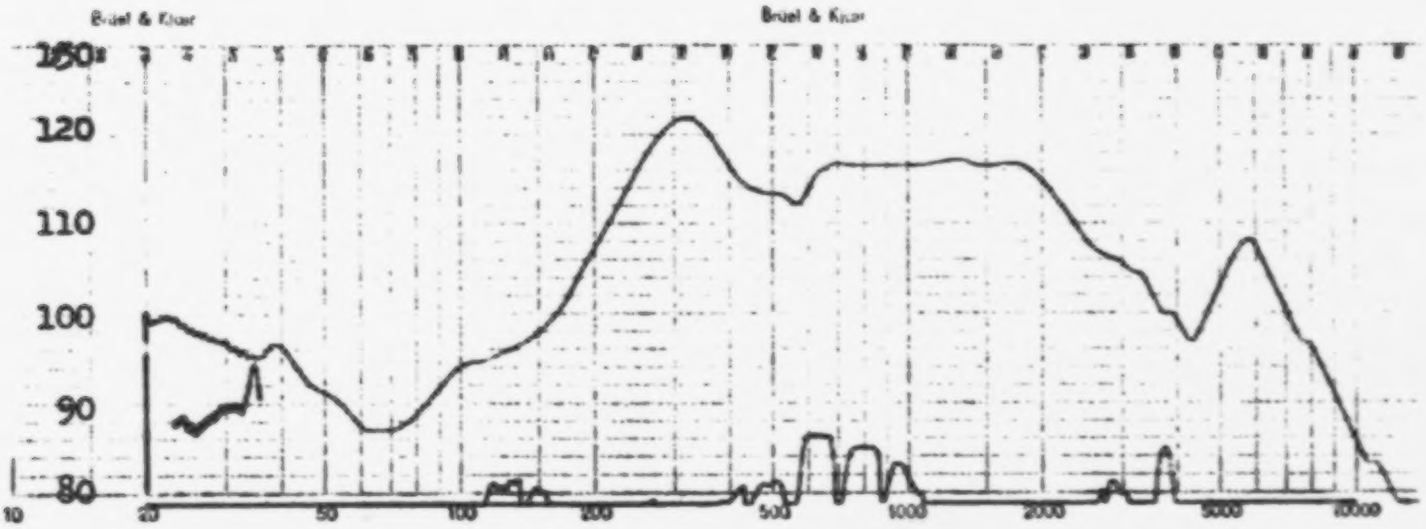


Figure 2 - Second Harmonic distortion. Input of 80 dB. Earphone balance control set at maximum. Receiver gain set at 5 dB below maximum.

ACOUSTA

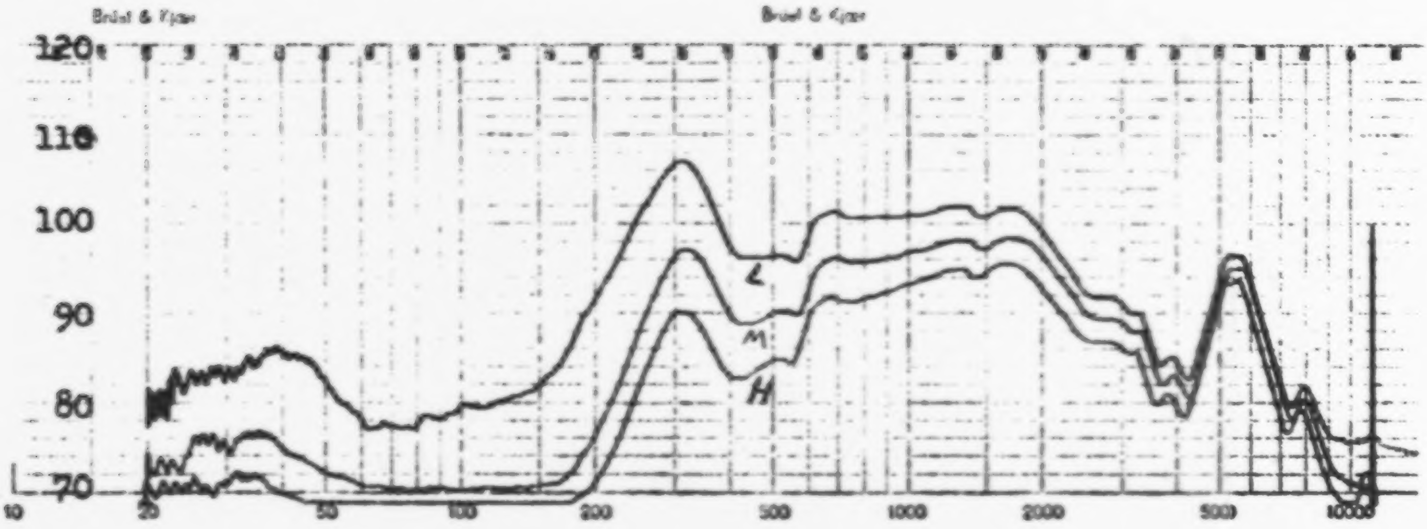


Figure 3 - Effect of tone control. Input of 60 dB. Earphone balance control set at maximum. Receiver gain set at maximum. Tone control set at low, medium, and high.

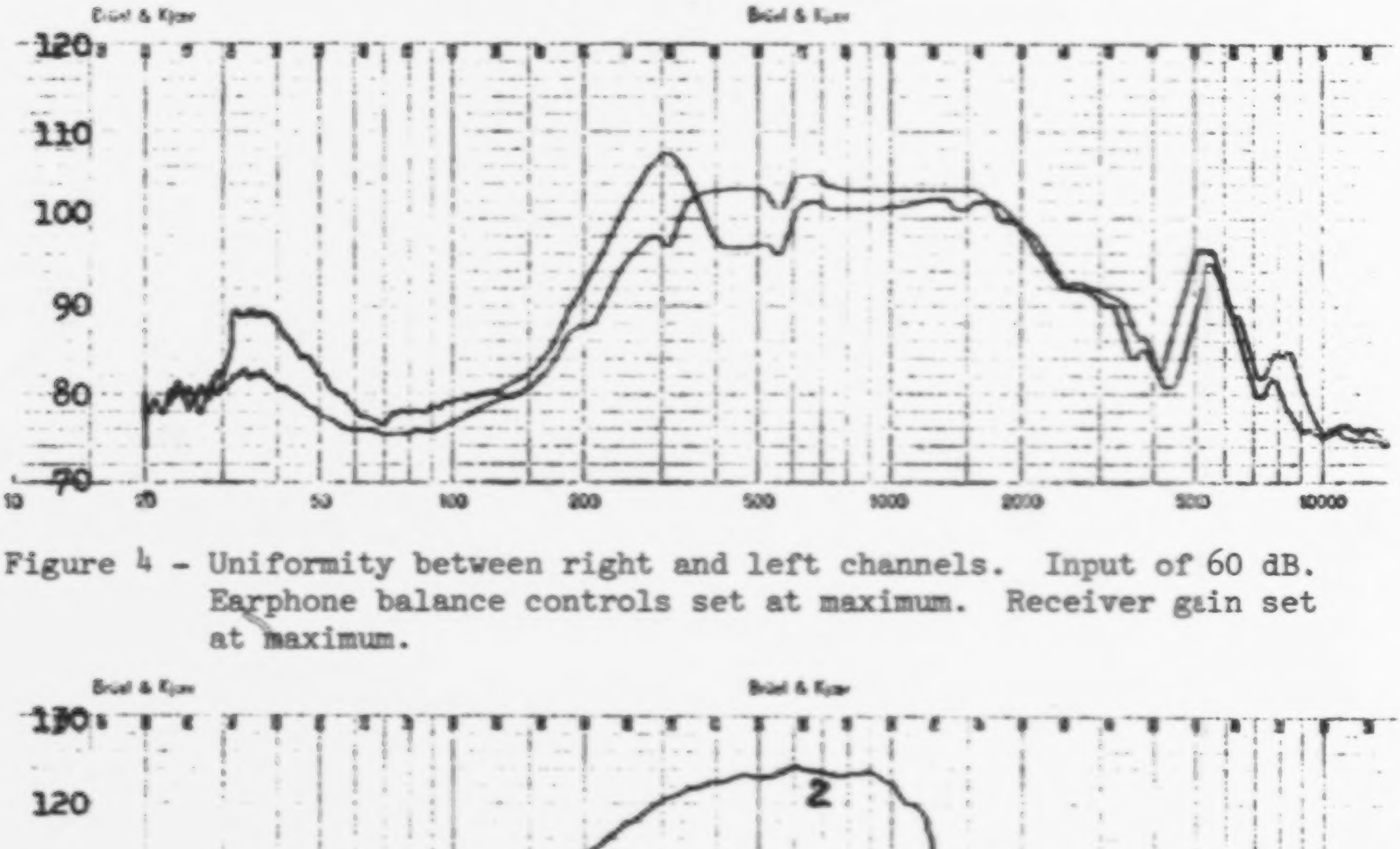


Figure 4 - Uniformity between right and left channels. Input of 60 dB. Earphone balance controls set at maximum. Receiver gain set at maximum.

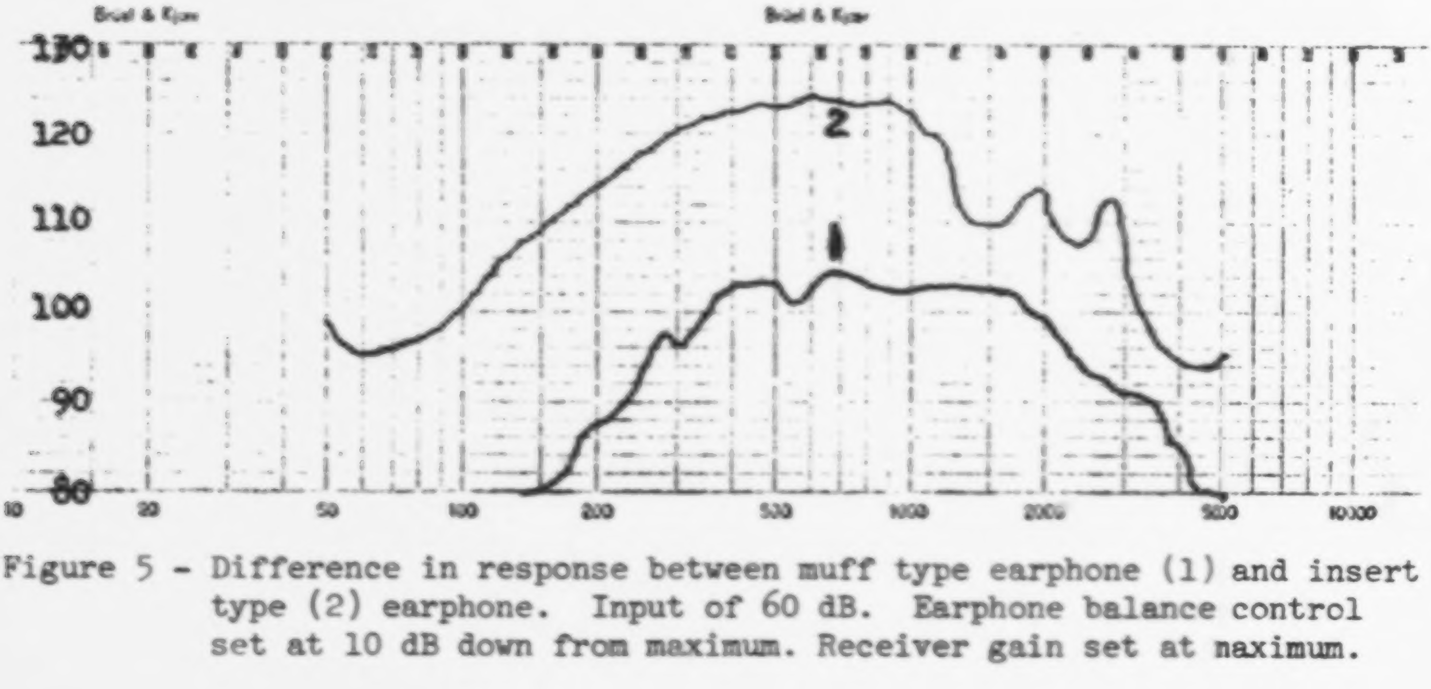


Figure 5 - Difference in response between muff type earphone (1) and insert type (2) earphone. Input of 60 dB. Earphone balance control set at 10 dB down from maximum. Receiver gain set at naximum.

ACOUSTA

Note: Student unit WR-10 only. Muff type earphones (AH-1) used except where noted.

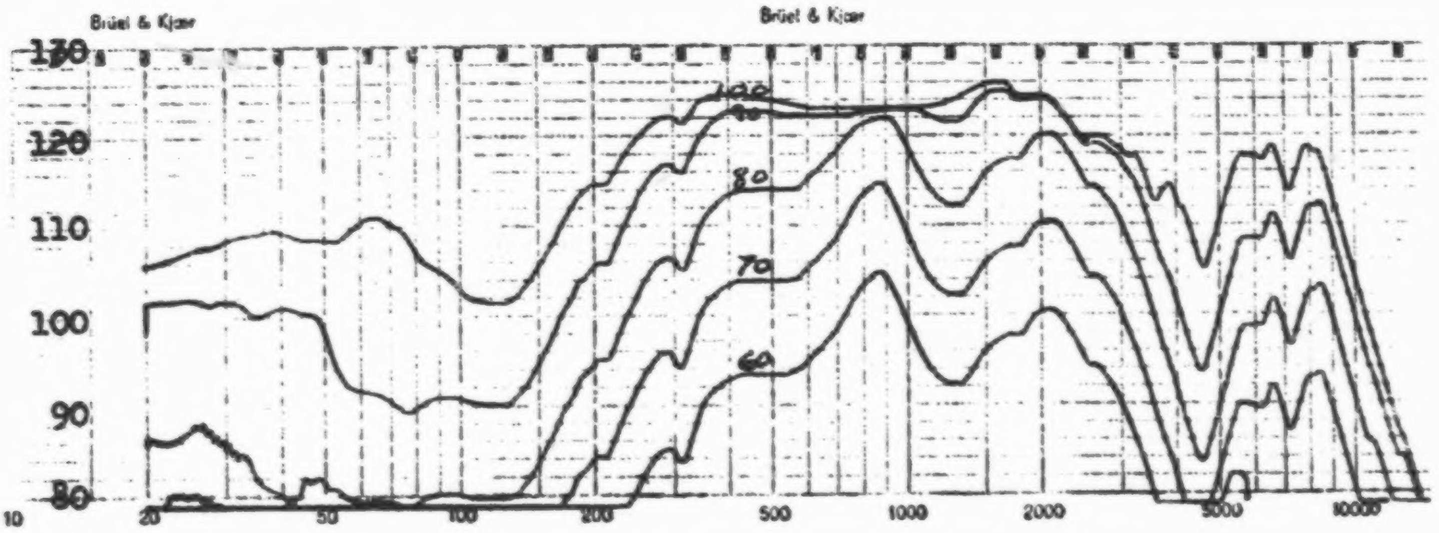


Figure 6 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB. Earphone balance control set at maximum. Mic. gain set at maximum.

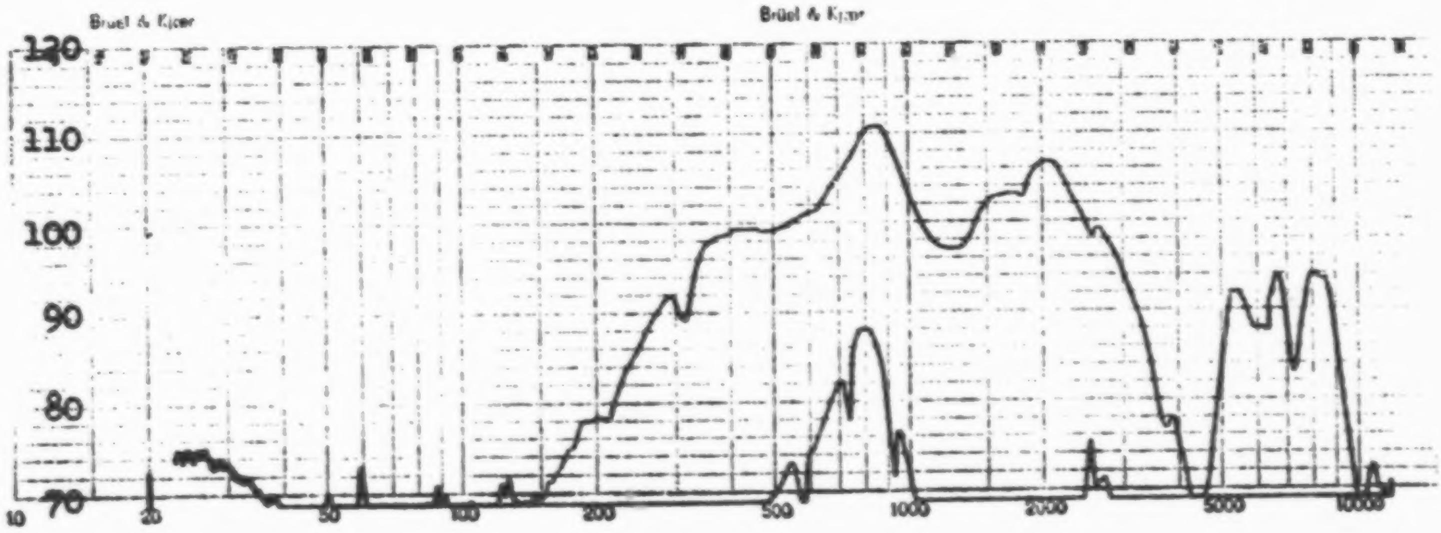


Figure 7 - Second Harmonic distortion. Input of 70 dB. Earphone balance control set at 5 dB below maximum. Mic. gain set at 5 dB below maximum.

ACOUSTA

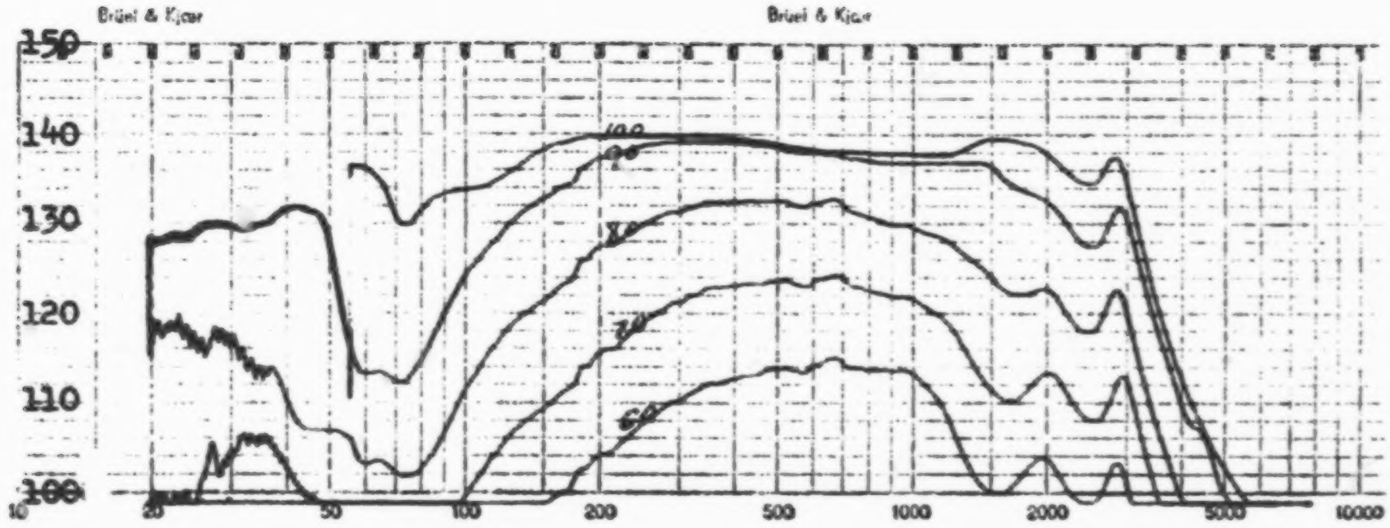


Figure 8 - Series of curves using insert type earphones at inputs of 60, 70, 80, 90, & 100 dB. Earphone balance control set at maximum. Mic. gain set at maximum.

QUALITY ASSURANCE

ACOUSTA RECEIVER WR-10

1. Case appears to be hard plastic. Ability to withstand shock due to handling, dropping, etc. very questionable.

2. Switch and control arrangement appears satisfactory.

3. Batteries are not readily replaceable. However, batteries are rechargeable in place.

4. General arrangement of parts and wiring is poor. Density of parts is extreme and wiring ties circuit board to other parts fixed to case. Parts are both standard commercial and foreign type.

5. Soldering on circuit board is extremely poor. Soldering is "piled on" and plastic in appearance ("cold solder"). Clearances between lands is reduced because of this condition and enhance the possibility of short circuits occuring during use. Presence of rosin and minute solder particles on board surface could provide leakage paths.

6. Maintainability of this would be extremely difficult.

QUALITY ASSURANCE

ACOUSTA TRAINED CONTROL WT-10

1. Case appears to be hard plastic. Ability to withstand shock due to handling, dropping, etc. very questionable.

2. Switch and control arrangement appears satisfactory.

3. Batteries are not readily replaceable. However, batteries are rechargeable in place.

4. General arrangement of parts and wiring is poor. Density of parts is extreme and wiring ties circuit board to other parts fixed to case. Parts are standard commercial type.

5. Soldering on circuit board is extremely poor. Soldering is "piled on" and plastic in appearance ("cold solder"). Clearances between lands is reduced because of this condition and enhance the possibility of short circuits occuring during use. Presence of rosin and minute solder particles on board surface could provide leakage paths.

6. Maintainability of this would be extremely difficult.

EDUCATIONAL SURVEY

ACOUSTA WR-10 and WT-10

1. Physical Description

The Acousta Auditory Trainer is a R.F. free field system with a built-in microphone, operating on DC power. The unit, consisting of five auditory trainers, comes with a charger storage rack which is to be wall mounted. The trainers have a permanent type rechargeable battery. The teacher's microphone is a lavalier type, somewhat bulky in size. The student's microphone cannot be operated simultaneously with the teacher's microphone. The neck strap is poorly designed, as the fastening is too easy to release and it is of questionable durability. The head phones are comfortable, light and easily adjustable. This unit will require service by an electronics technician.

2. Quality

The fine tuning would be difficult for a child to operate. The trainer has to be pre-set, using a screw driver, for the individual use of each student. The trainer is built using some foreign parts and the workmanship, in general, is very poor. Parts and batteries may be difficult to obtain.

3. Performance

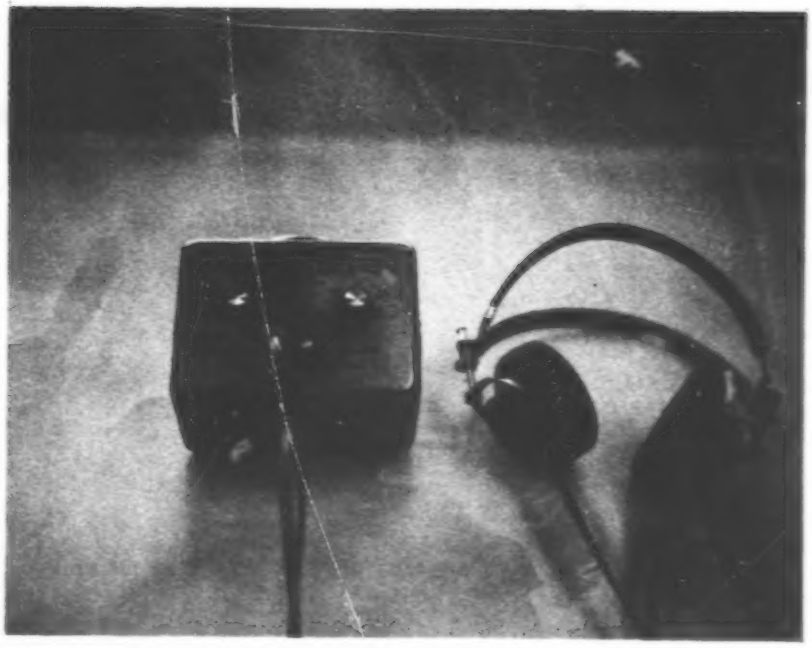
The range of reception was satisfactory for classroom use. During the trial test, the trainer picked up reception from a commercial FM station.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

Can be used as a conventional hearing aid.

AMBCO

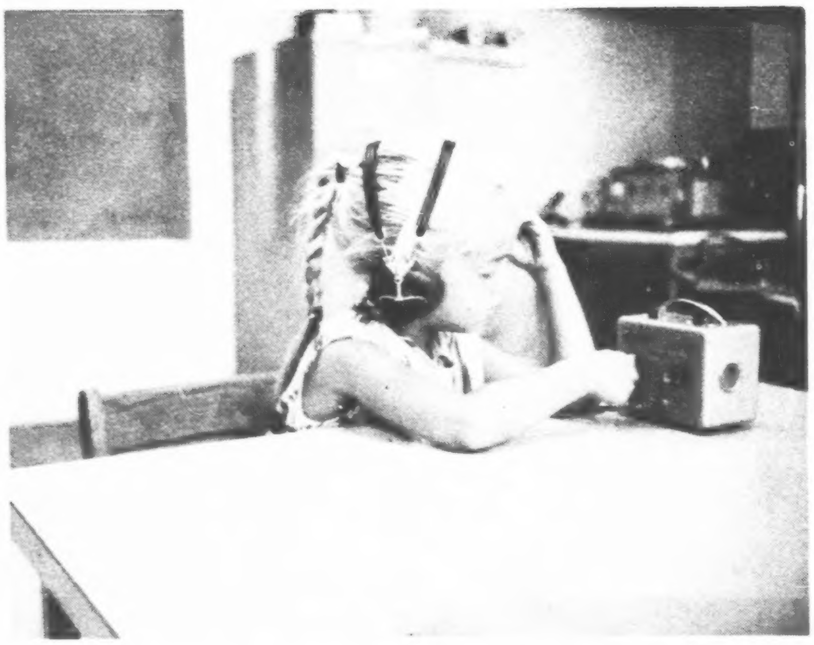


AUDITORY TRAINER

903

AMBCO

903



ACOUSTICAL RESPONSE

AMBCO 903

Frequency response uniformity, Figure 1, is considered to be poor in view of the sharp drop off after 500 Hz and then the jaggedness of the curve after 1000 Hz.

Harmonic distortion, Figure 2, is very low and registers only 3.6% at its highest point at 400 to 500 Hz.

Effect of tone control, Figure 3, is rated good by our test criteria, however, the emphasis is somewhat in the wrong direction to our way of thinking.

Uniformity between channels, Figure 4, is only fair in that there are deviations of up to 8 dB at 500 Hz and 1300 Hz.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	44	310 - 5200	124

AMBCO - Model 903

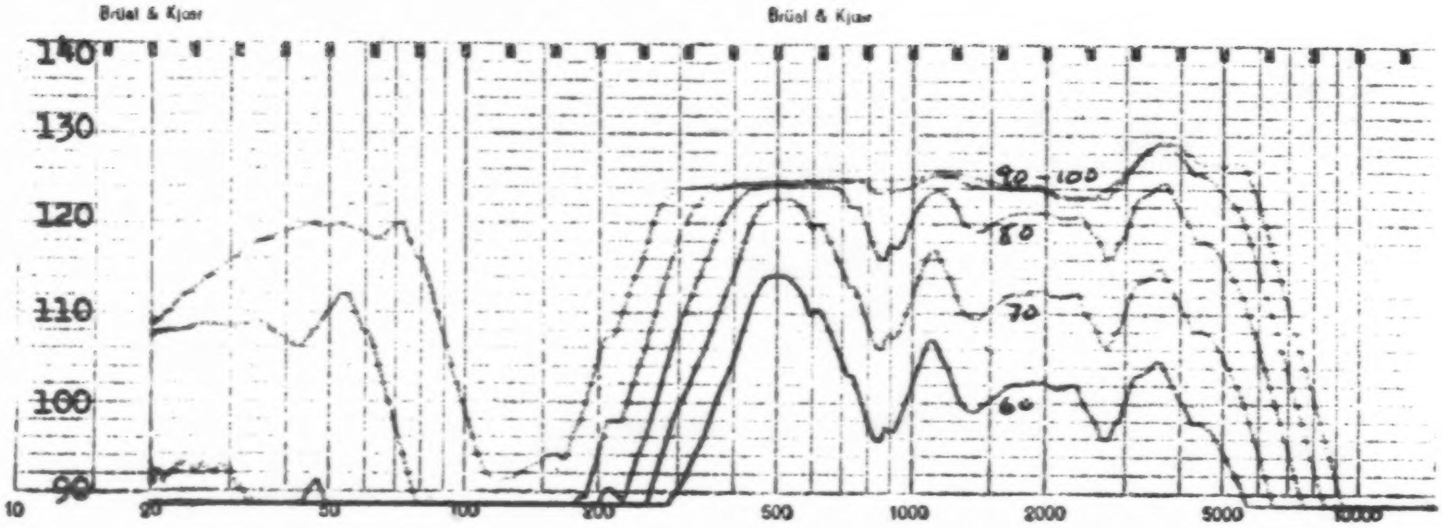


Figure 1 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB. Bass-treble control set at bass. Gain control set at maximum.

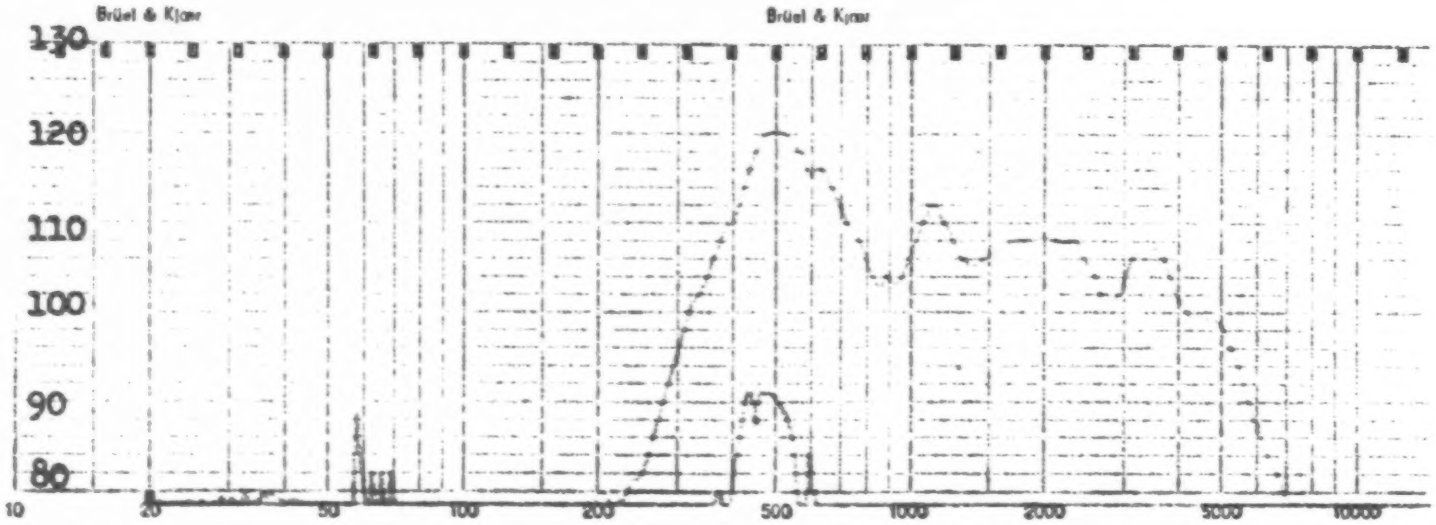


Figure 2 - Second Harmonic distortion. Input of 70 dB. Gain control set at 5 dB below maximum. Bass-treble control at bass.

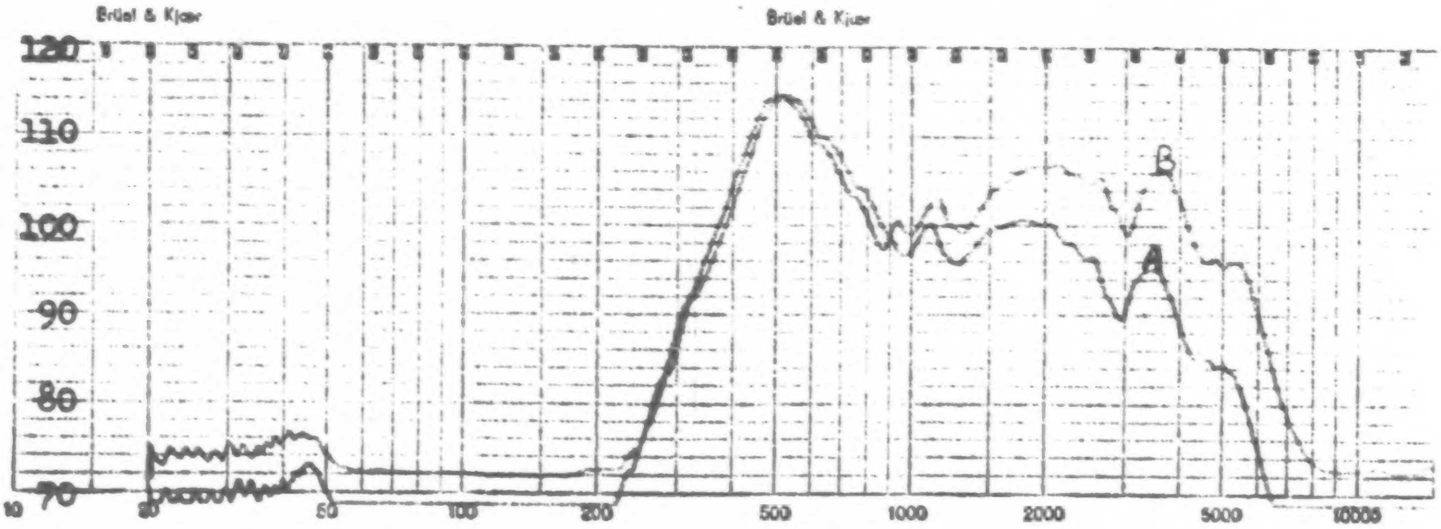


Figure 3 - Effect of bass-treble control. Input of 60 dB. Gain control set at maximum. Curve A - bass, Curve B - treble.

AMBCO - Model 903

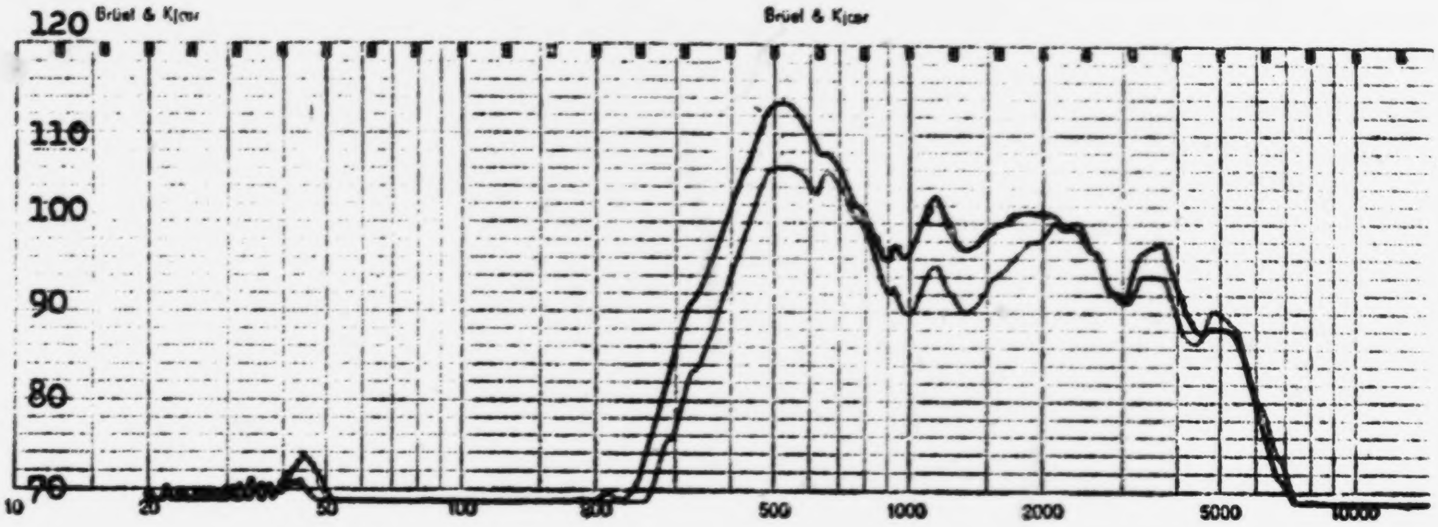


Figure 4 - Uniformity between channels. Input of 60 dB. Gain controls set at 100 dB. Bass-treble control set at bass.

QUALITY ASSURANCE

AMBCO 903

1. Metal case should provide for serviceability. Control arrangement appears satisfactory.
2. Batteries are readily replaceable without unsoldering of wire leads.
3. General arrangement of parts and wiring is good.
4. Soldering and general workmanship is good and should permit good service and maintainability.
5. Parts appear to be standard commercial type.

EDUCATIONAL SURVEY

AMBCO 903

1. Physical Description

A self-contained,portable,bilateral unit that permits the student to control her own amplification. The hand carried unit allows the student unlimited mobility. The compact unit operates on a non-rechargeable battery. Battery replacement represents an additional continuing operating expense. The unit requires student head sets. Those provided are cushion type with limited adjustability. The relatively stiff headband is uncomfortable. Batteries can be replaced by the teacher. Other services will require an electronic's technician.

2. Quality

The straight plug-in jack might be a source of trouble. A right angle jack might be a more satisfactory connection.

3. Performance

The unit tone control exerts emphasis in the wrong direction. The frequency response uniformity is unsatisfactory.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

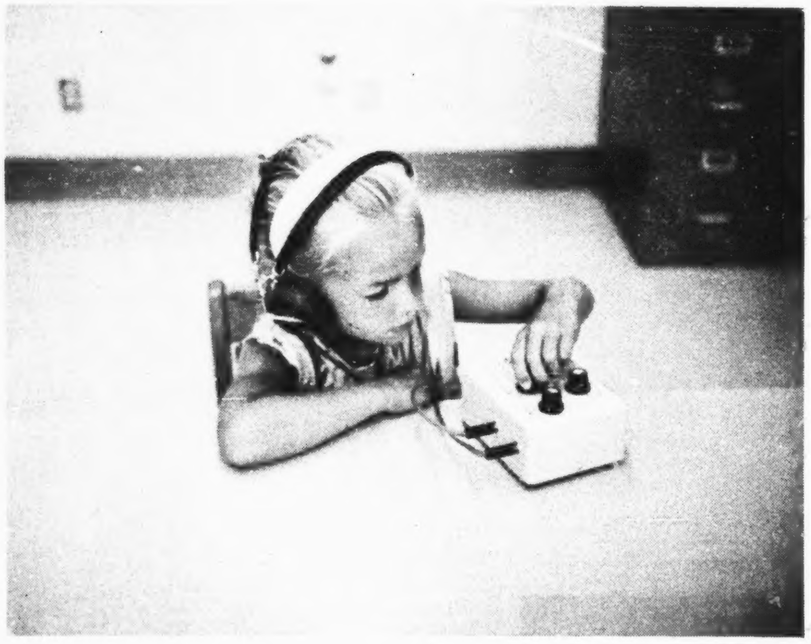
AMBCO

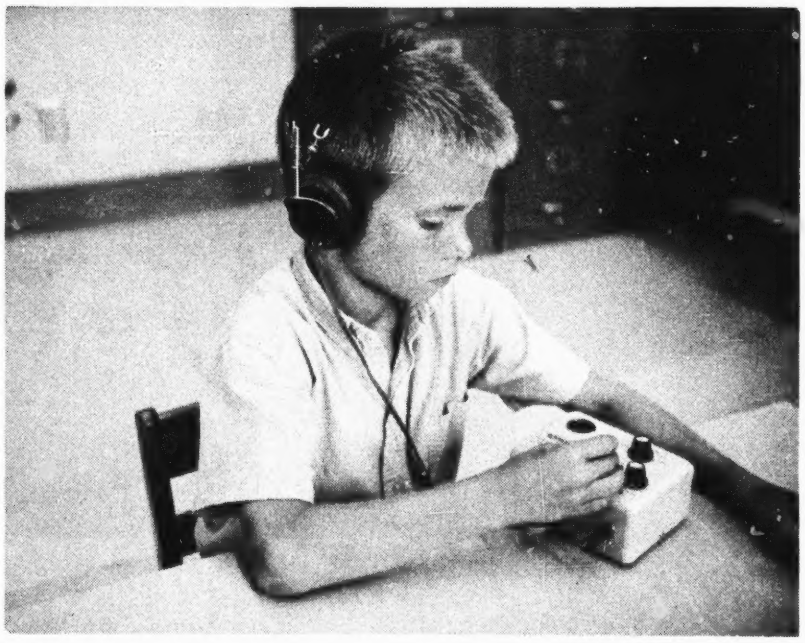
AUDITORY TRAINER

954

A
M
B
C
O

954





ACOUSTICAL RESPONSE

AMBCO 954

Frequency response uniformity, Figure 1, is considered to be poor in view of the 15 dB deviation in response between 500 Hz and 1000 Hz and the 10 dB rise between 2000 Hz and 3000 Hz.

Harmonic distortion, Figure 2, was found to be low at only 7% at its highest point at 2000 Hz.

Uniformity between channels, Figure 3, was found to be excellent in that the two channels were within 2 dB of each other throughout the effective range of the instrument.

A check of the output attenuator reveals that it is not functioning as it is meant to function, i.e., limiting the output. The calibration marking on this control was therefore considered to be poor.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	48	280 - 6000	124

AMBCO - Model 954

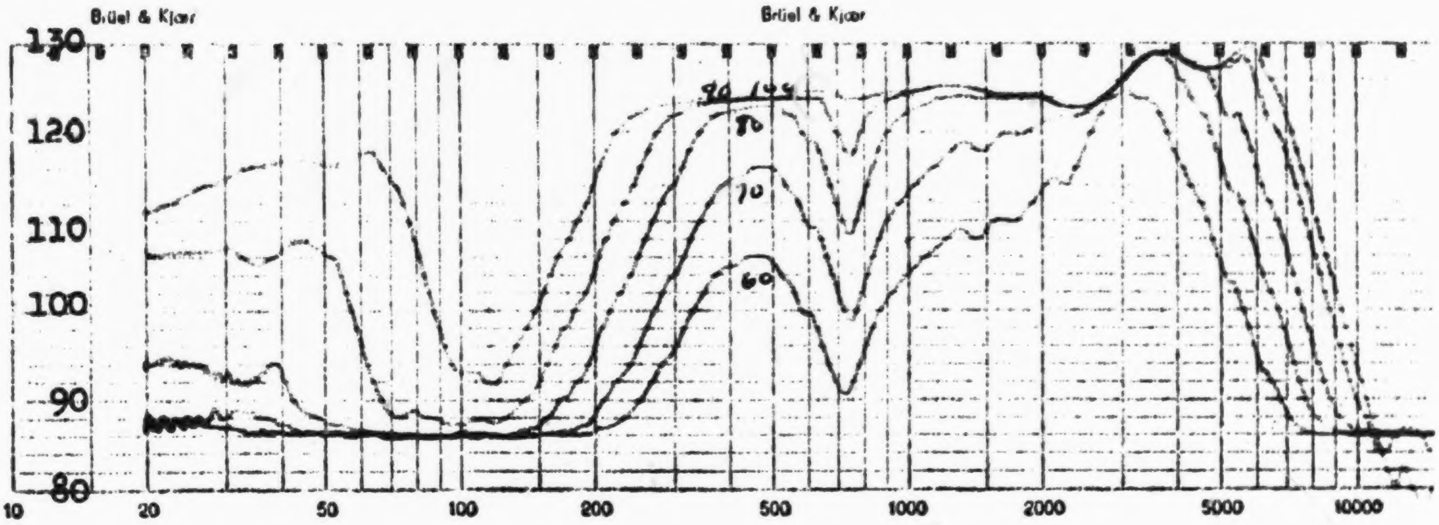


Figure 1 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB.
Output attenuator set at 130 dB. Volume control set at maximum.

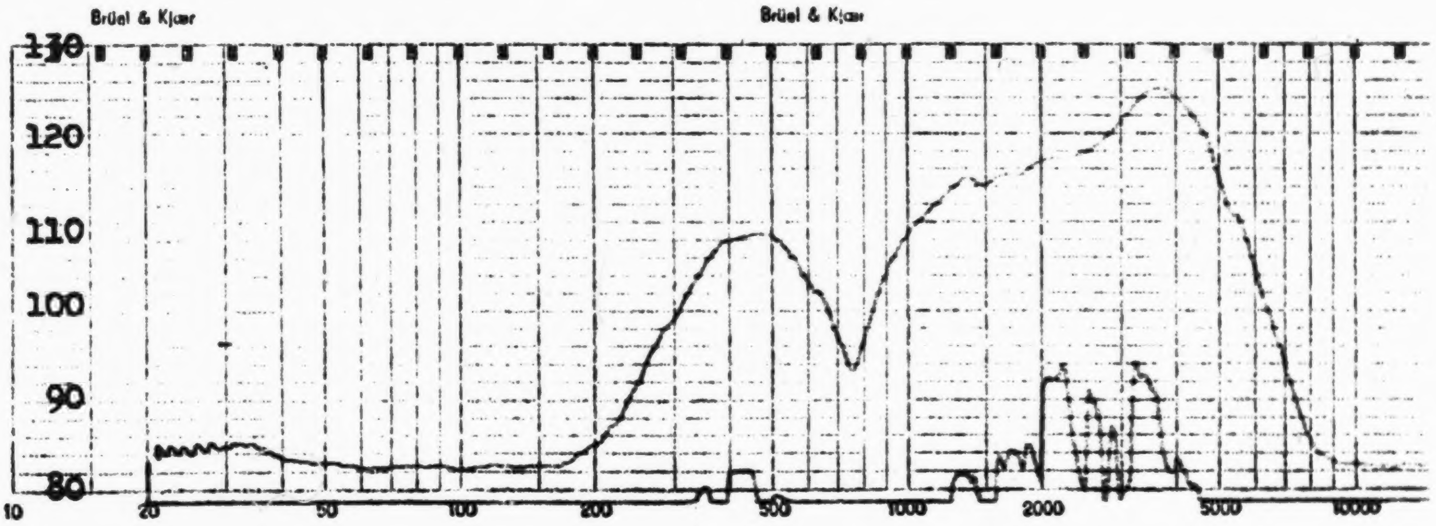


Figure 2 - Second Harmonic distortion. Input of 70 dB, output attenuator set at 130 dB. Volume control set at 5 dB below maximum.

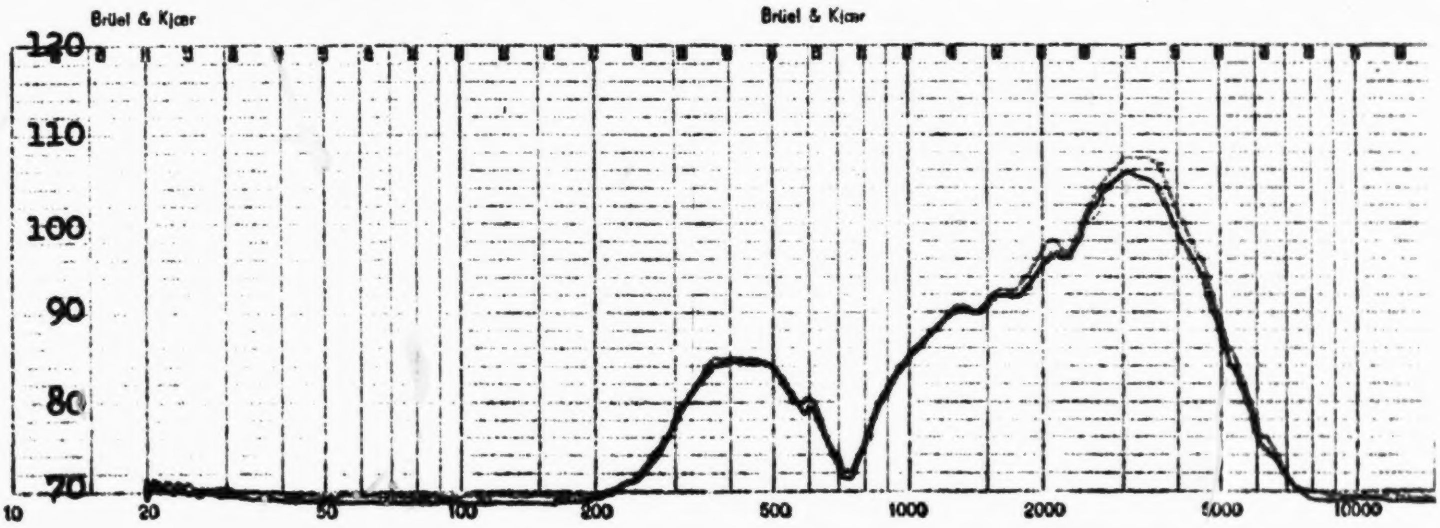


Figure 3 - Uniformity between channels. Input of 60 dB, output attenuator set at 130 dB. Volume control set at ½ (sixth dot).

AMBCO - Model 954

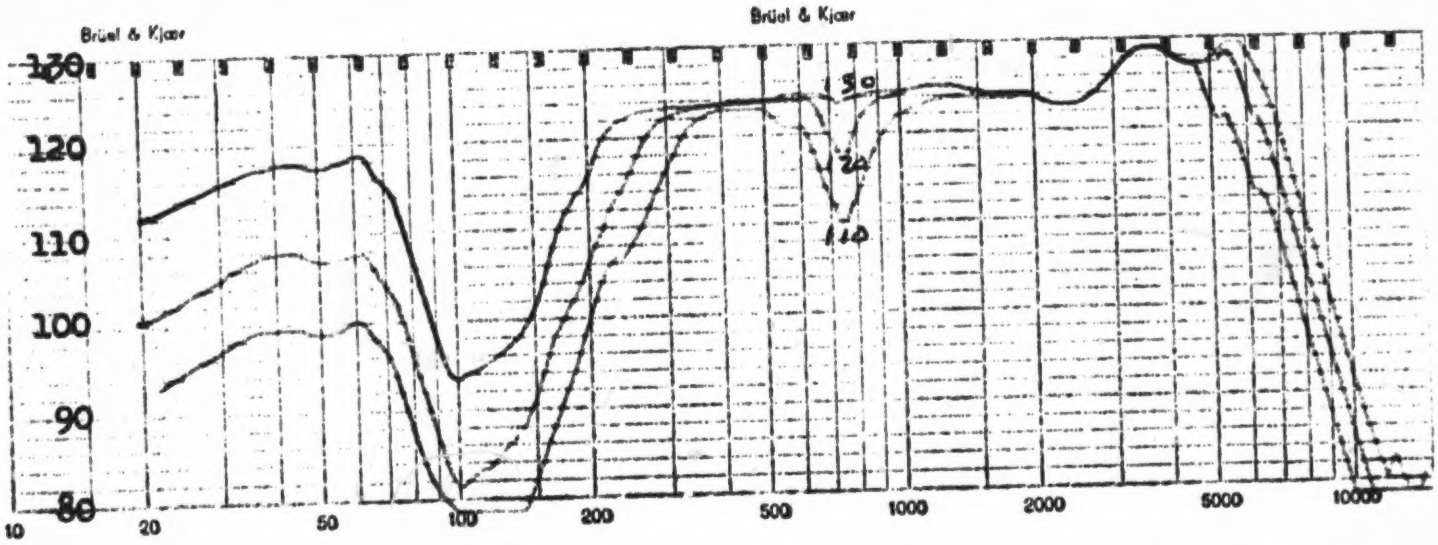


Figure 4 - Test of output attenuator. Input of 100 dB, output attenuator set at 110, 120, & 130 dB. Volume control set at full.

QUALITY ASSURANCE

AMBCO 954

1. Metal case should provide for serviceability. Control arrangement appears satisfactory.

2. Batteries are readily replaceable without unsoldering of wire leads.

3. General arrangement of parts and wiring is good.

4. Soldering and general workmanship is good and should permit good service and maintainability.

5. Parts appear to be standard commercial type.

EDUCATIONAL SURVEY

AMBCO 954

1. Physical Description

The Ambco 954 is a bilateral Y cord, self-contained, portable unit which allows for student mobility by hand carrying. The power is supplied by non-rechargeable batteries which represent an expense in maintenance. The standard cushion type headsets have limited adjustability. This type of head band is uncomfortable. The student may adjust his own controls.

2. Quality

See Quality Assurance for this unit.

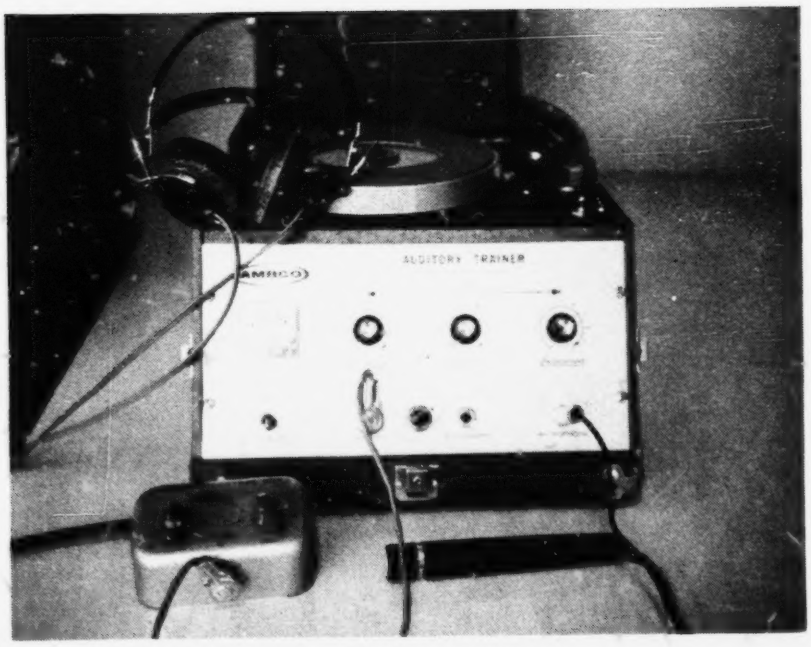
3. Performance

The frequency response uniformity is unsatisfactory.

4. Educational Suitability

Ed. Levels	INDIVIDUAL Deaf	INDIVIDUAL H.H.	SELF CONTAINED Deaf	SELF CONTAINED H.H.	INTEGRATED Deaf	INTEGRATED H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

A M B C O


AMBCO
AUDITORY TRAINER

AUDITORY TRAINER

1400

ACOUSTICAL RESPONSE

AMBCO 1400

Frequency response uniformity using TDH 39 earphones with the MX41AR cushion, Figure 1, is considered to be good for the range of 100 Hz to 5000 Hz and excellent from 100 Hz to 3000 Hz. We have made this exception in our rating because of the excellent uniformity throughout the major speech range. When using insert earphones, Figure 4, a rather high peak was noted at 1200 Hz followed by a rapid fall off, giving the unit a poor rating in this category.

Harmonic distortion was found to be very low with either type of earphones, Figure 2 and Figure 5.

Uniformity between channels, Figure 3 and Figure 6, was excellent and remained within 2 dB for both types of earphones.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	55	100 - 7400	135
insert earphone	58	100 - 2900	141

AMBCO - Model 1400
with 1451 X Student Control Box

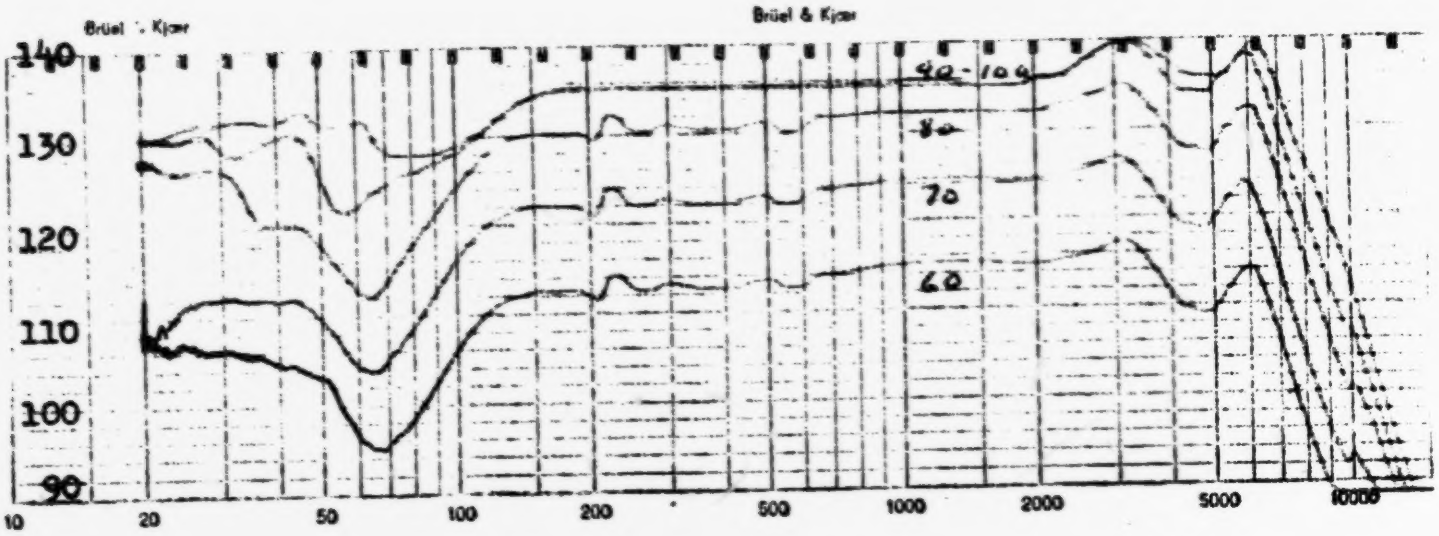


Figure 1 - Series of curves using TDH39 earphones. Input of 60, 70, 80, 90, & 100 dB. Mic. control set at maximum, student control set at maximum.

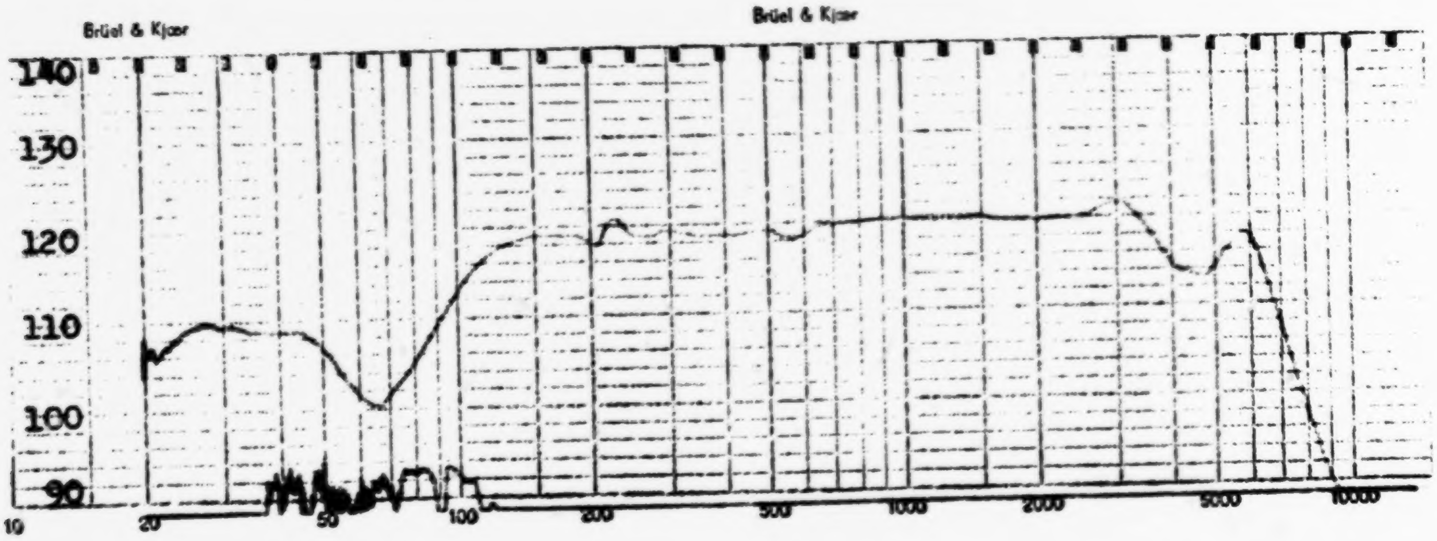


Figure 2 - Second Harmonic distortion with TDH39 earphones. Input of 70 dB. Mic. gain set at 5 dB below maximum, student control set at maximum.

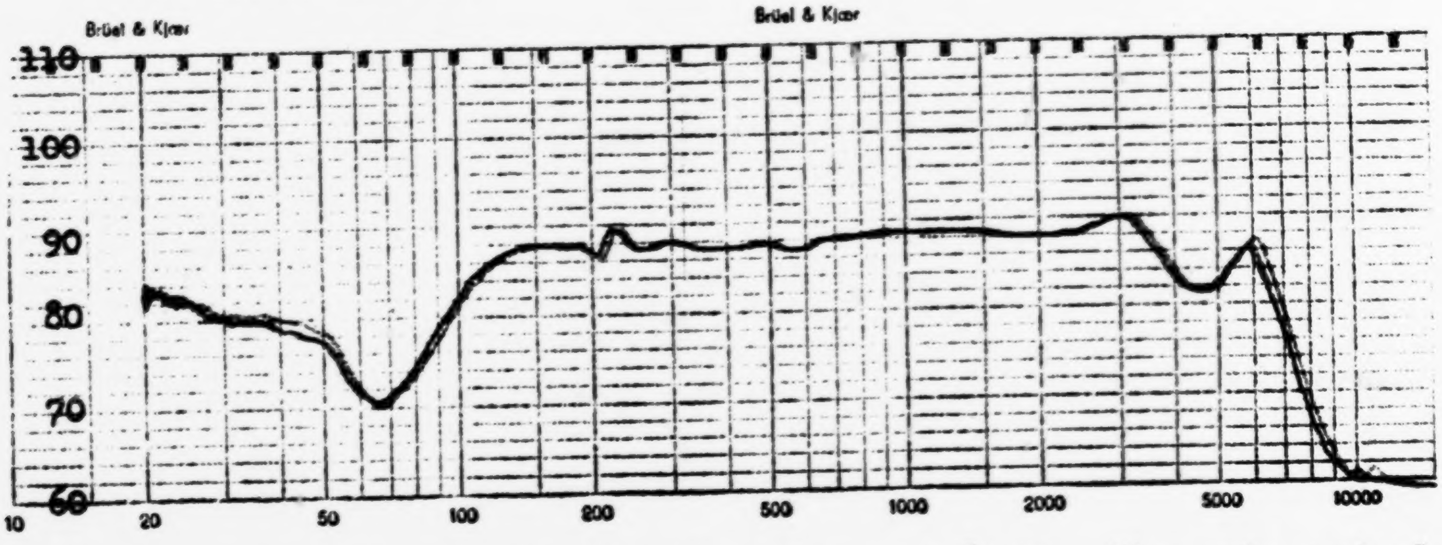


Figure 3 - Uniformity between channels. Input of 60 dB. Mic. gain control set at 8, student controls set at 8.

AMBCO - Model 1400
with 1451 X Student Control Box

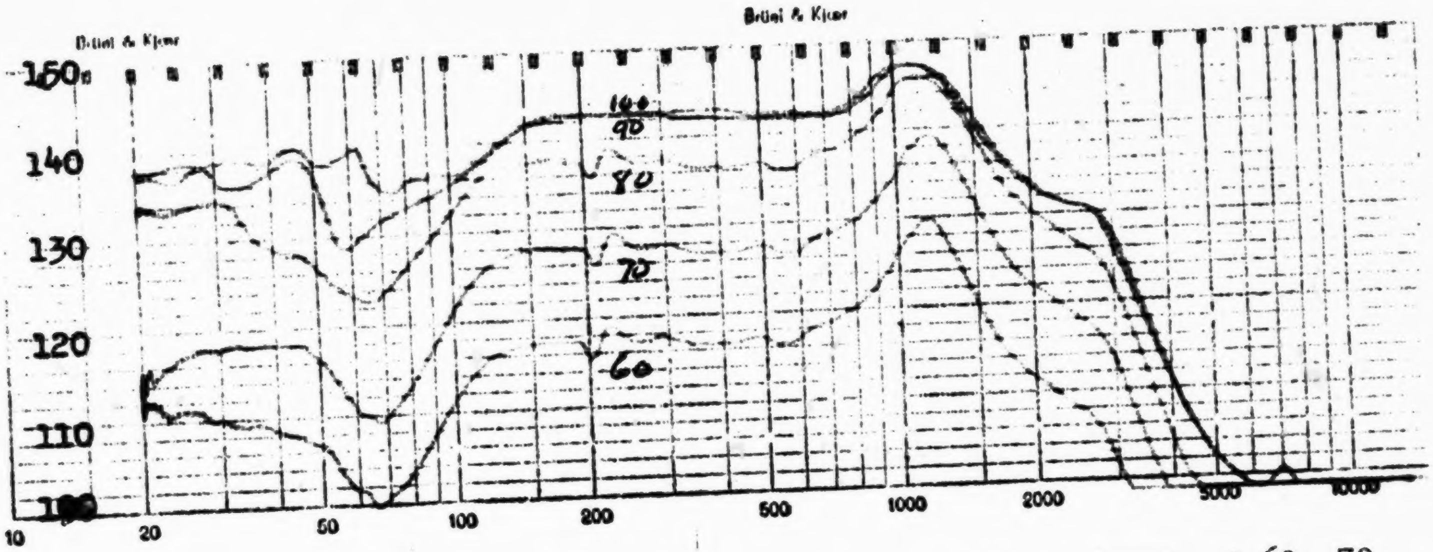


Figure 4 - Series of curves using inset type earphones. Input of 60, 70, 80, 90, & 100 dB. Mic. control set at maximum, student control set at maximum.

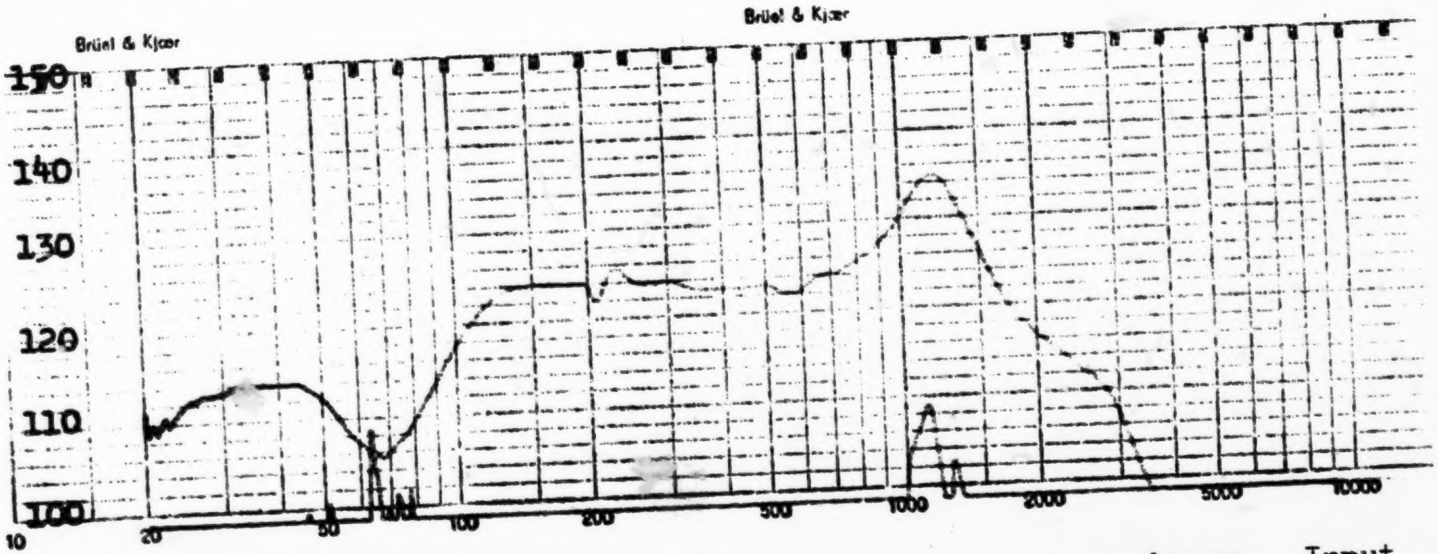


Figure 5 - Second Harmonic distortion using insert type earphones. Input of 70 dB. Mic. gain set at 5 dB below maximum, student control set at maximum.

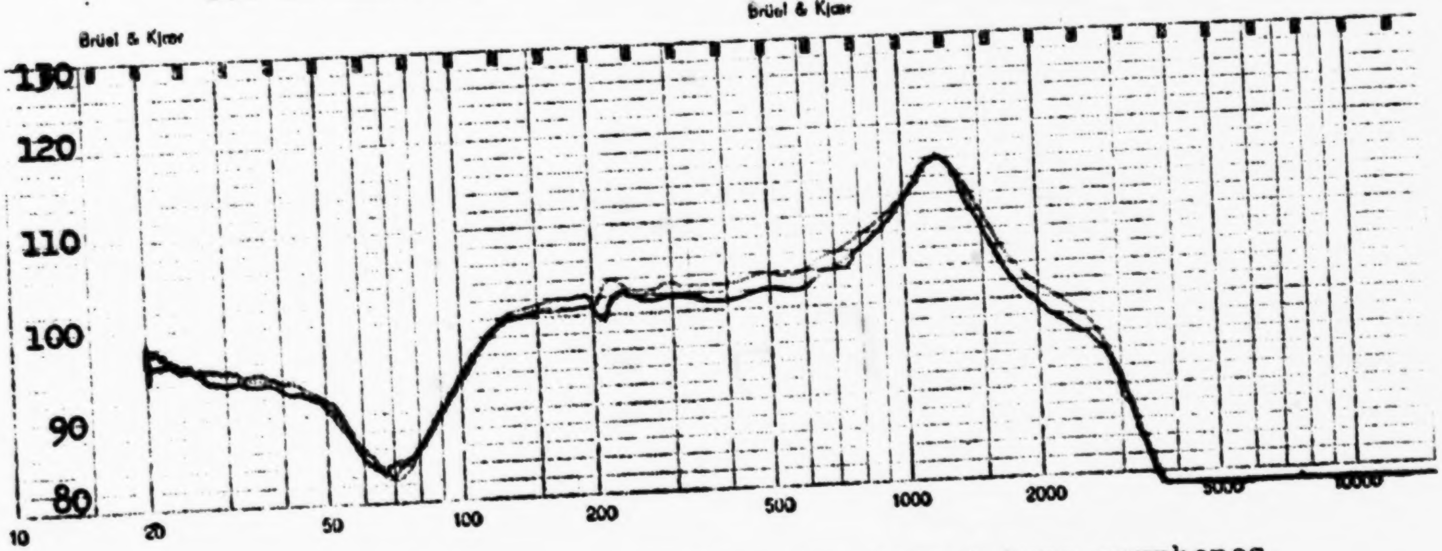


Figure 6 - Uniformity between channels using insert type earphones. Input of 60 dB. Mic. gain control set at 8, student controls set at 8.

QUALITY ASSURANCE

AMBCO 1400

1. Metal panel and chassis with vinyl covered wood on outer container. Fair serviceability.
2. Controls are well arranged and markings are clear and distinguishable.
3. Parts arrangement and accessibility are good.
4. General workmanship is good. Soldering is very good.
5. Parts are standard commercial type.
6. Service and maintainability aspects are very good.

AMBCO STUDENT CONTROL BOX 1451 X (black knobs)

1. Metal case should provide for serviceability. Control arrangement appears satisfactory.
2. General arrangement of parts and wiring is good.
3. Soldering and general workmanship is good and should permit good service and maintainability.
4. Parts appear to be standard commerical type.

This is a different model control box than that which is called for in the manual of the model 1400 trainer. It is, however, usable.

EDUCATIONAL SURVEY

AMBCO 1400

1. Physical Description

The Ambco 1400 is a hard wire group, monaural system connected by cables to the student control box. The student mobility is limited due to the cables and the permanent mounting of the student junction boxes. The student may adjust volume with a separate control for each ear. The tacher adjusts other controls. The unit is powered by AC current. The teacher uses a floor or table microphone or a lavalier. There are no student mikes. The headphones are standard cushion type. Headbands provide limited adjustability. The MX41AR cushions are uncomfortable. Inserts are optional. This unit will require service by a service electronics technician.

2. Quality

The turntable and tone arm are of unsatisfactory quality.

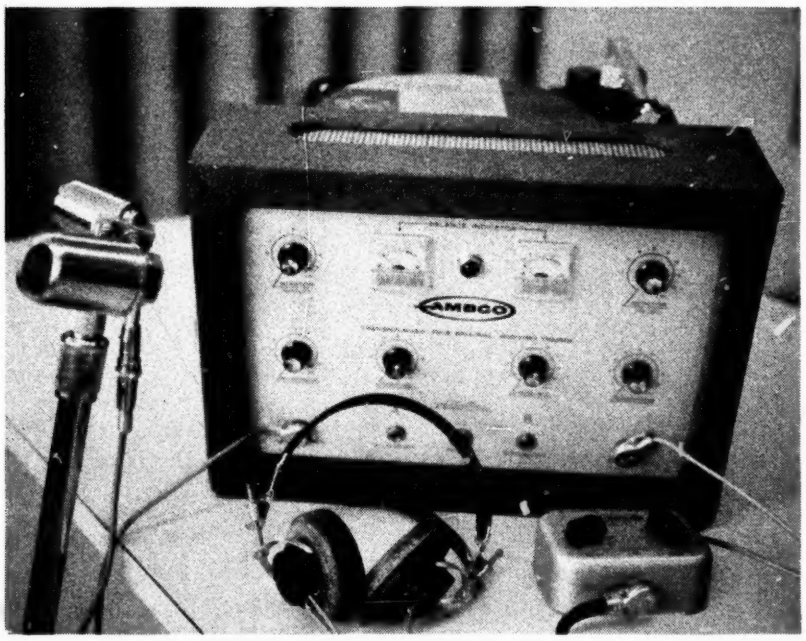
3. Performance

There is a poorer frequency response, and uniformity is poorer with the use of insert receivers.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

AMBCO



BINAURAL AUDITORY TRAINER

1450

ACOUSTICAL RESPONSE

AMBCO 1450

Frequency response uniformity, using TDH 39 earphones with the MX41AR cushion, Figure 1, was good with slight fluctuations occuring after 1000 Hz. When using insert earphones, Figure 4, a rather high peak was noted at 1200 Hz followed by a rapid fall off, giving the unit a poor rating in this category.

Harmonic distortion was found to be very low when using TDH 39 earphones, Figure 2, and low, Figure 5, when using the insert type earphone.

Uniformity between channels, Figure 3, was poor when using the TDH 39 earphones with a spread of as much as 12 dB being recorded. With the insert earphones the unit was rated as fair.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	51	100 - 6000	137
insert earphones	56	100 - 2900	141

AMBCO - Model 1450
with 1451 X Student Control Box

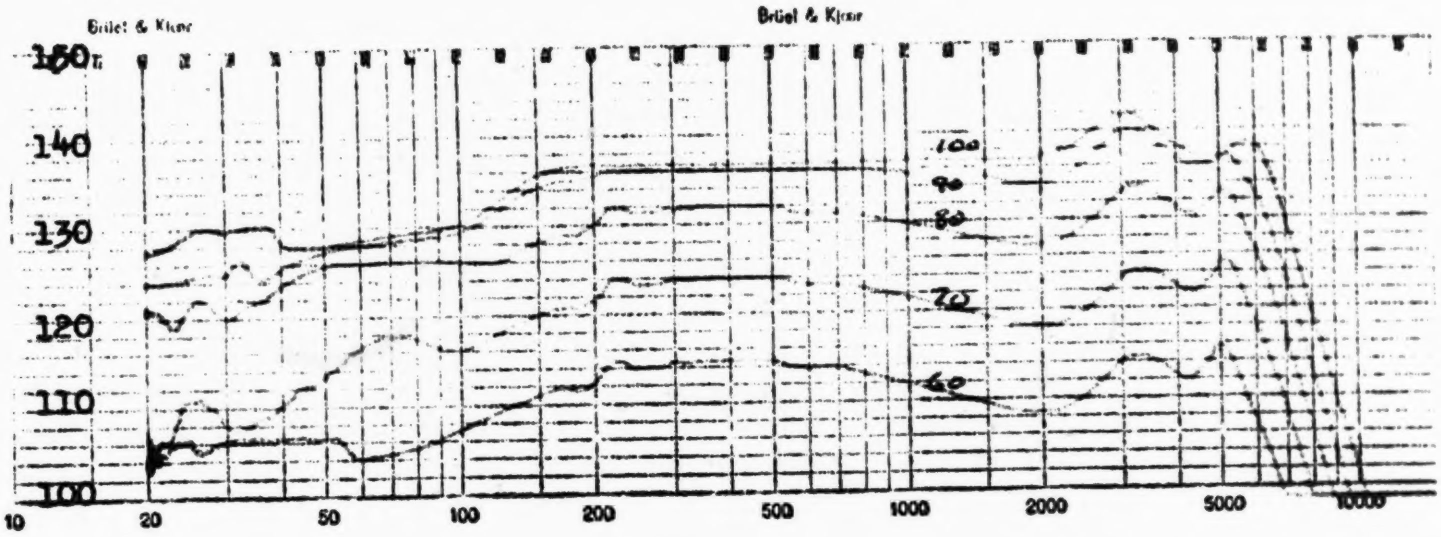


Figure 1 - Series of curves using TDH39 earphones. Input of 60, 70, 80, 90, & 100 dB. Mic. control set at maximum and student controls set at maximum.

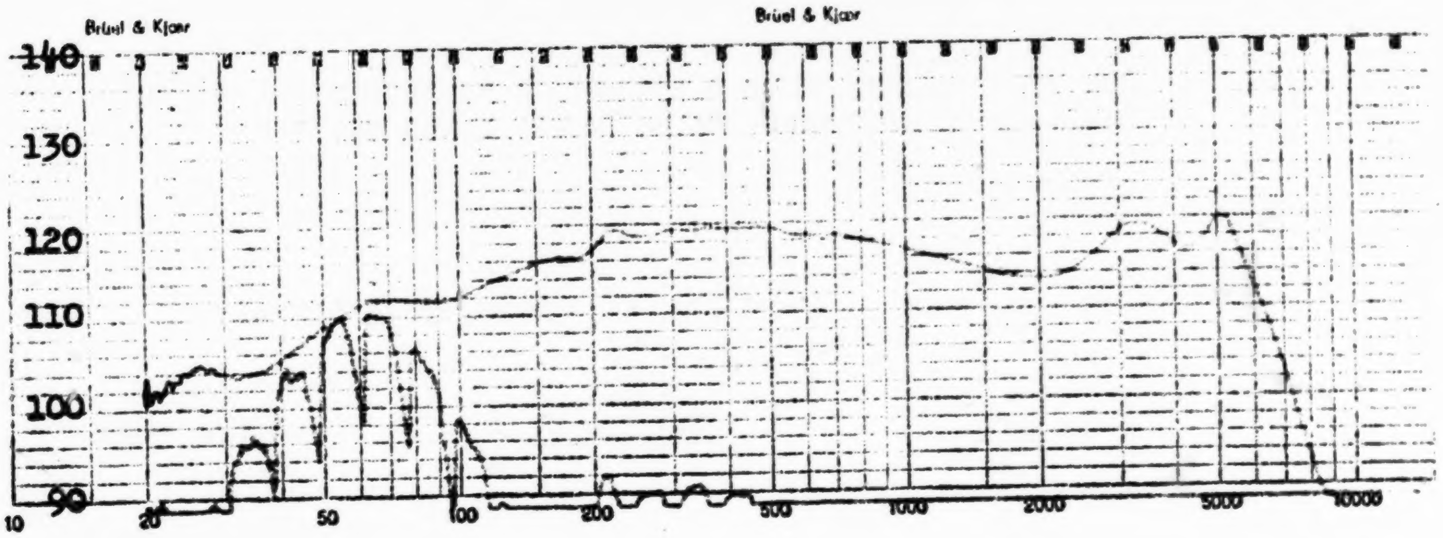


Figure 2 - Second Harmonic distortion using TDH39 earphones. Input of 70 dB. Mic. gain set at 5 dB below maximum, student controls set at maximum.

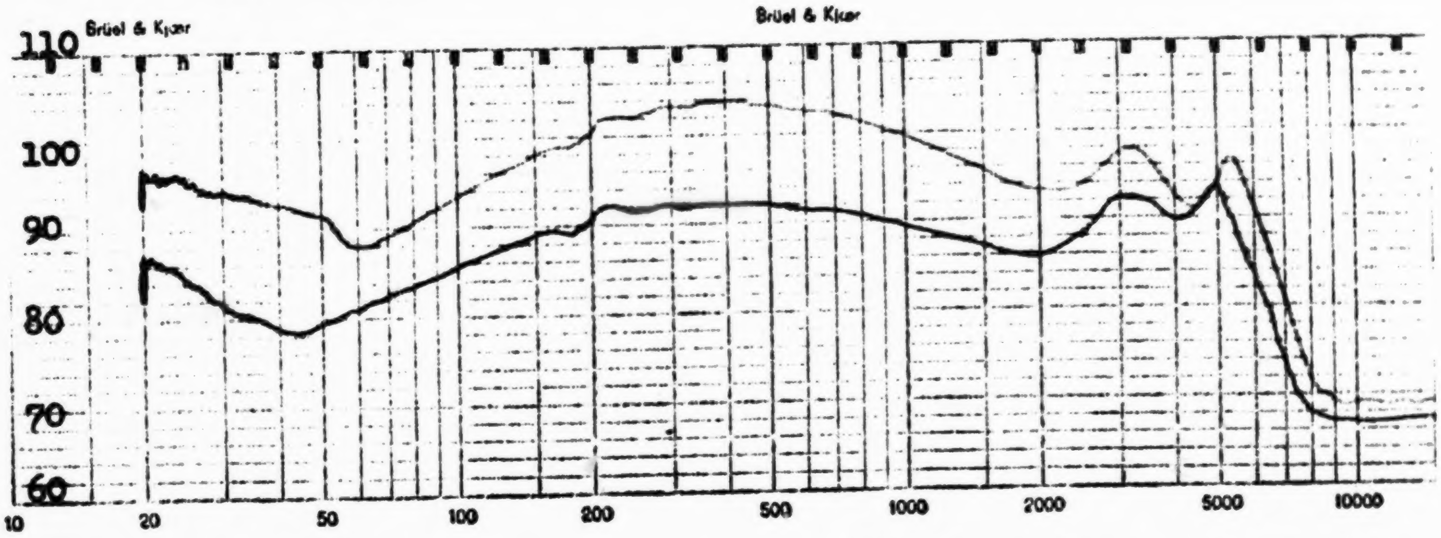


Figure 3 - Uniformity between channels using TDH39 earphones. Input of 60 dB. Mic. gain controls set at 8, student controls set at 8.

AMBCO - Model 1450
with 1451 X Student Control Box

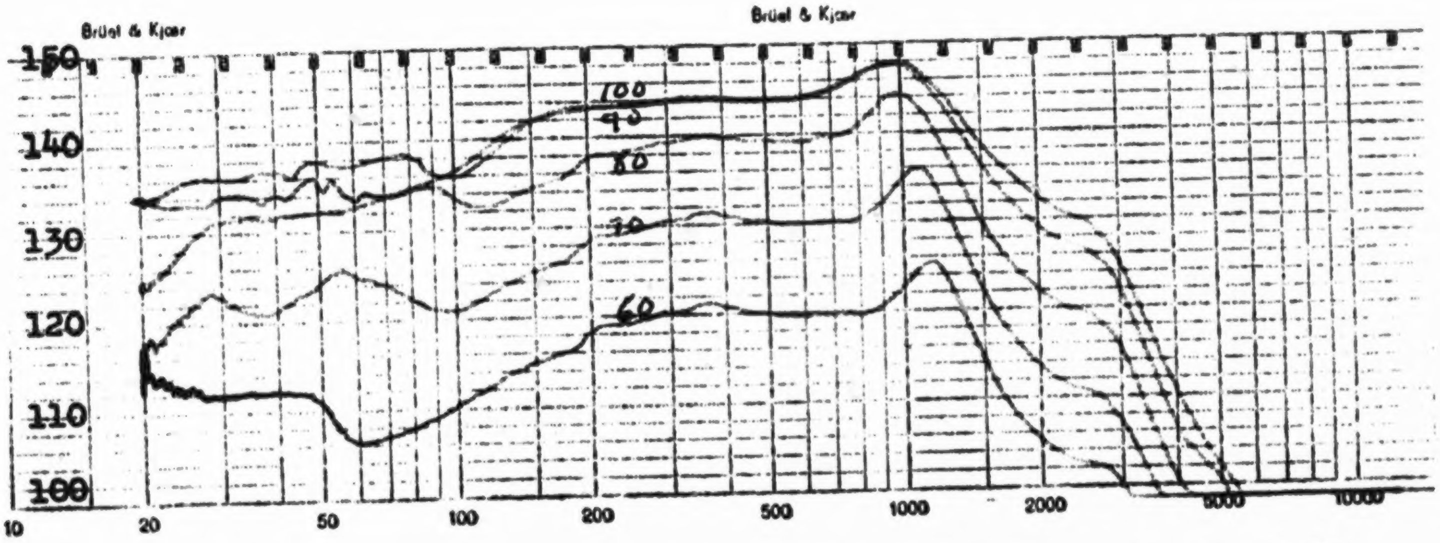


Figure 4 - Series of curves using insert type earphones. Inputs of 60, 70, 80, 90, & 100 dB. Mic. control set at maximum, student control set at maximum.

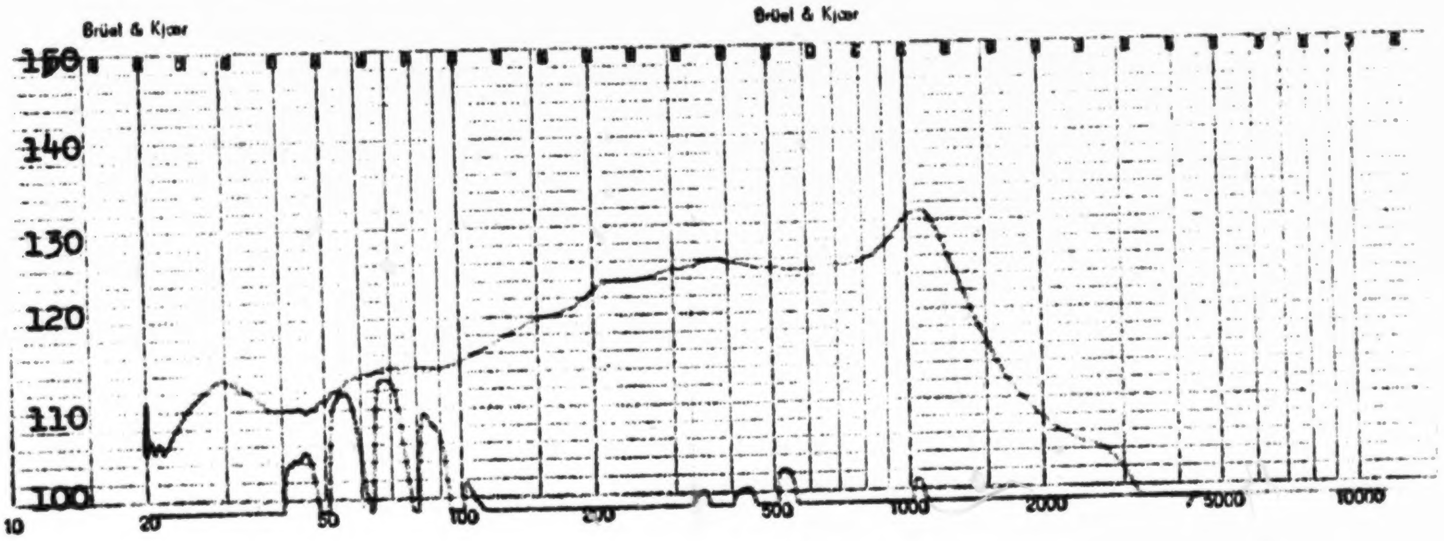


Figure 5 - Second harmonic distortion with insert earphones. Input of 70 dB. Mic. gain set at 5 dB below maximum, student control set at maximum.

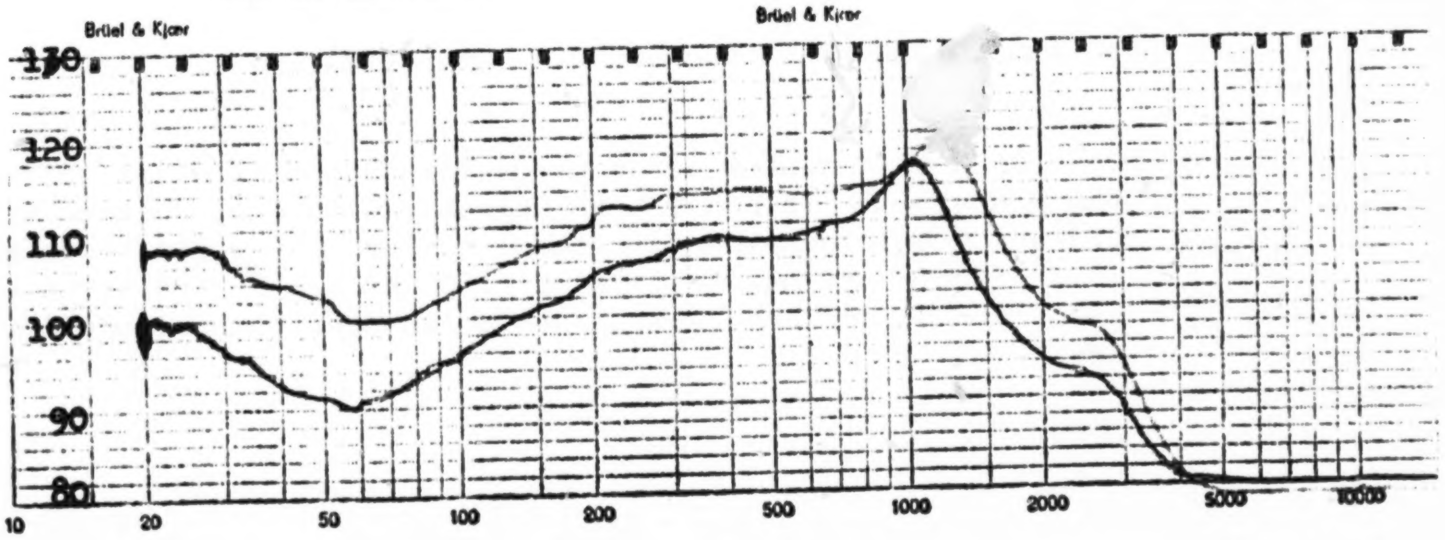


Figure 6 - Uniformity between channels using insert earphones. Input of 60 dB. Mic. gain controls are set to meter red line at 1000 Hz with 80 dB input, student controls set at 8.

QUALITY ASSURANCE

AMBCO 1450

1. Metal panel and chassis with vinyl covered wood on outer container. Fair serviceability.
2. Controls are well arranged and markings are clear and distinguishable.
3. Parts arrangement and accessibility are good.
4. General workmanship is good. Soldering is very good.
5. Parts are standard commercial type.
6. Service and maintainability aspects are very good.

AMBCO STUDENT CONTROL BOX 1451 X (red knobs)

1. Metal case should provide for serviceability. Control arrangement appears satisfactory.
2. General arrangement of parts and wiring is good.
3. Soldering and general workmanship is good and should permit good service and maintainability.
4. Parts appear to be standard commercial type.

This is a different model control box than that which is called for in the manual. It is not interchangeable with the one used with the 1400 trainer yet it has the same model number. It would be very confusing if a school happened to order a 1450 and a 1400 trainer and received them both at the same time, such as we did, packed together in a common box.

EDUCATIONAL SURVEY

AMBCO 1450

1. Physical Description

A fixed binaural, hard wire, group system, that includes a console and student junction boxes, and operates on AC current. The main unit is operated by the teacher. Student operation volume controls are fixed, thereby limiting the student mobility. The stand provided with the teachers microphone is unsatisfactory. No student microphone is provided. The head sets are standard cushion type. The rigid headbands are uncomfortable.

2. Quality

Although the student control boxes of 1400 and 1450 have the same code numbers, the purchaser must indicate the model he is using, for these boxes are not interchangeable between the 1400 and 1450. Service by an electronics technician only.

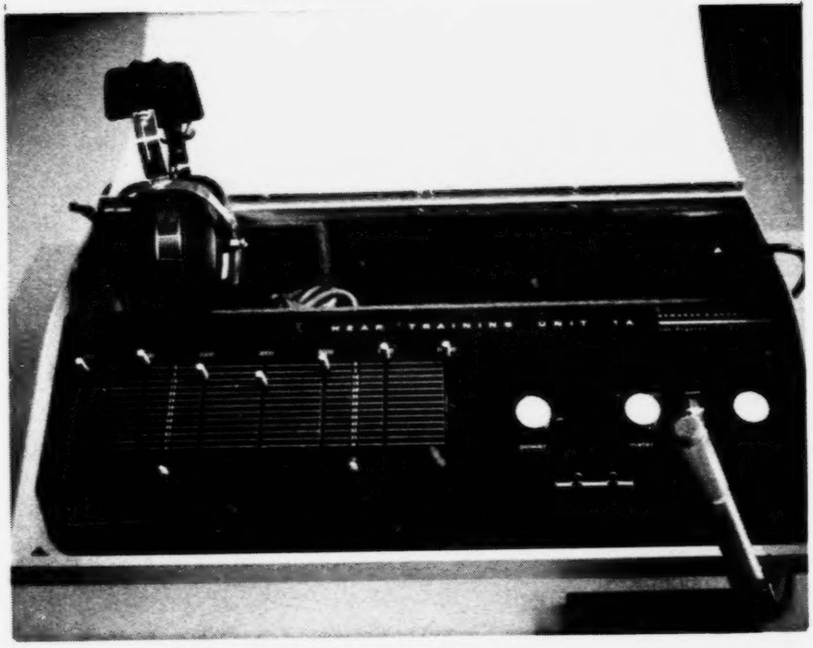
3. Performance

Poor frequency response and range. Unit unsatisfactory with the use of insert receiver.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

DEMAREE


HEAR TRAINING UNIT 1A

TRAINING UNIT

1A

ACOUSTICAL RESPONSE

DEMAREE 1A

Frequency response uniformity, Figure 1, fell into the poor category because of the extreme jaggedness of the curve.

Harmonic distortion was rather high, reaching 45% distortion at 500 Hz and 25% distortion at 3800 Hz.

The three-step power output control limits the output at about 127 dB, 106 dB, and 90 dB, Figure 4. The control markings, however, are 100, 80, & 60 which is somewhat difficult to relate to. The control does limit the output, however, in nearly 20 dB steps and was therefore rated as good.

Tone control variability is considered to be the best of all units evaluated, Figure 5 and Figure 6. The slide attenuators allow for about a 30 dB per octave attenuation for all octaves from 250 Hz to 15000 Hz.

Uniformity between channels was good with only a 5 dB spread being recorded at about 1700 Hz.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
Sharpe earphones	50	100 - 20000	127

It should be noted that the HTU 1A, because of the full filter system for spectrum shaping, is different from any other equipment tested.

DEMAREE & ASSOCIATES

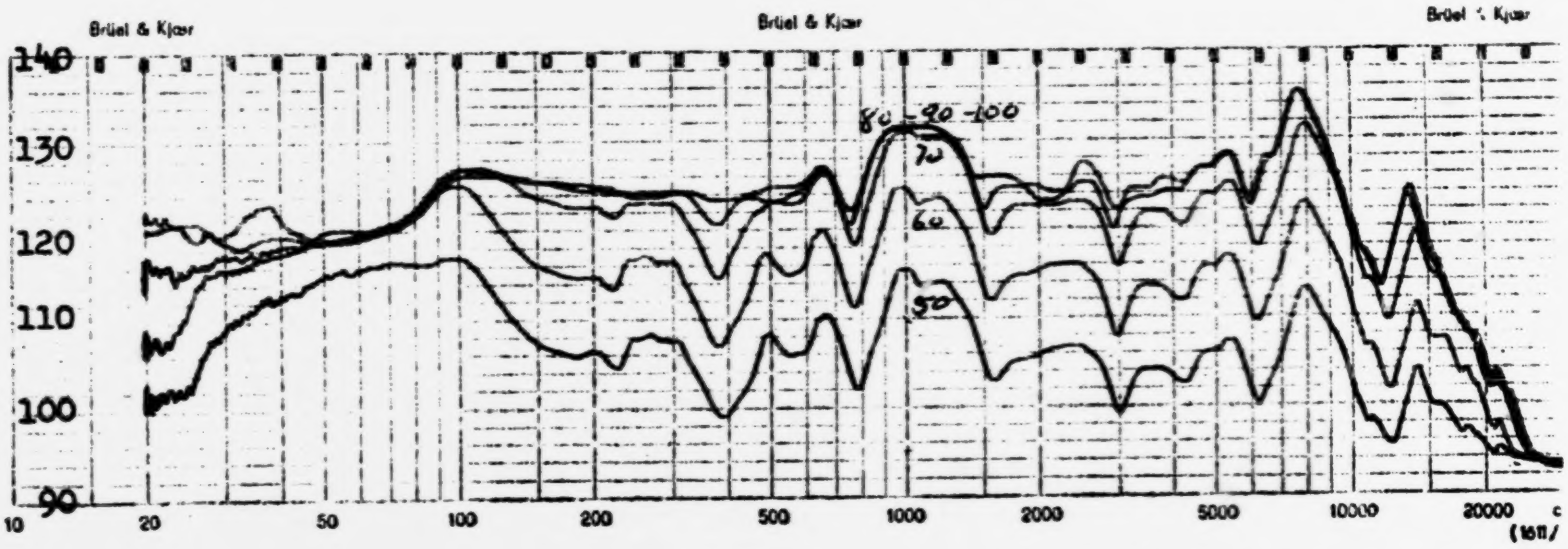


Figure 1 - Series of curves at inputs of 50, 60, 70, 80, & 90 dB. Power control set at 100 dB, volume control set at maximum. All filters set at zero attenuation.

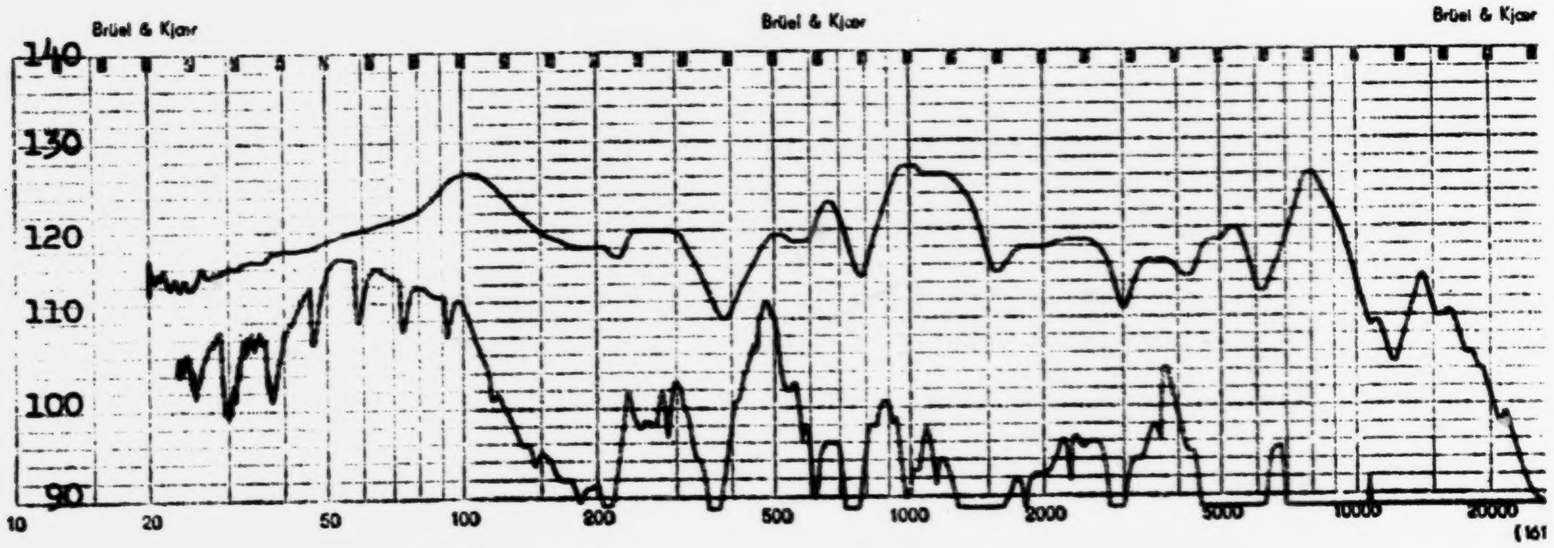


Figure 2 - Harmonic distortion test. Input of 70 dB. Power output control set at 100 dB, volume control set at 5 dB below maximum. All filters set at zero attenuation.

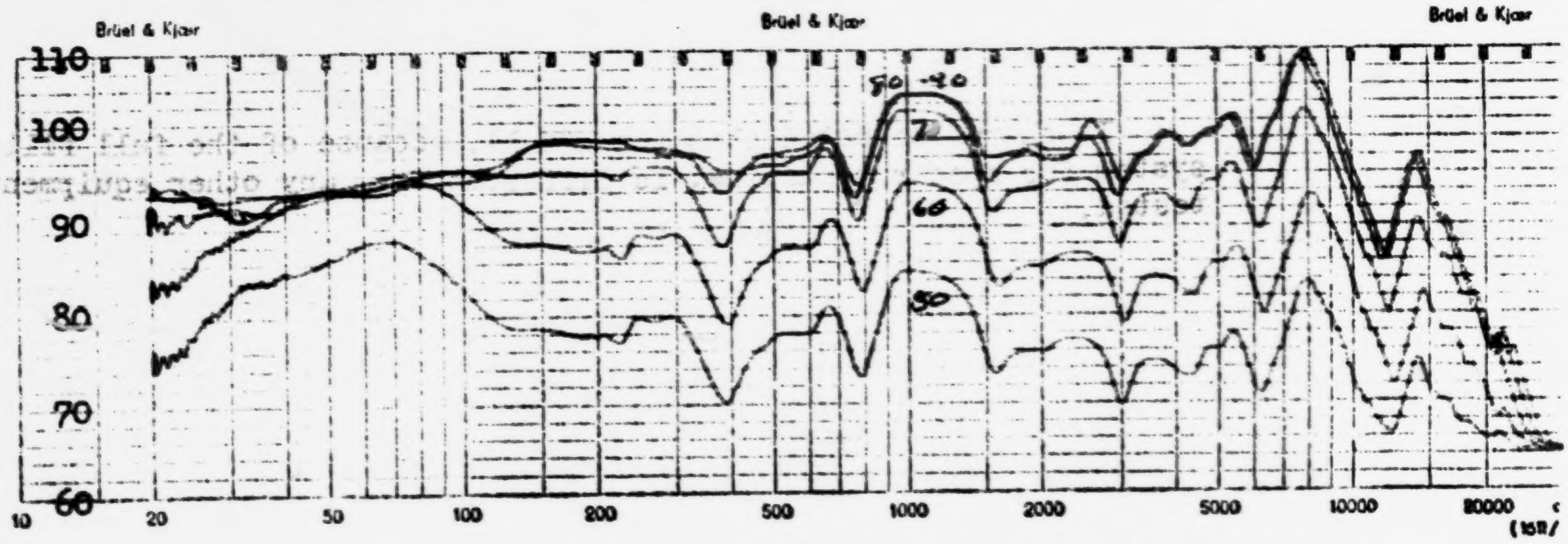


Figure 3 - Series of curves at inputs of 50, 60, 70, 80, & 90 dB. Power output control set at 80 dB, volume control set at maximum. All filters set at zero attenuation.

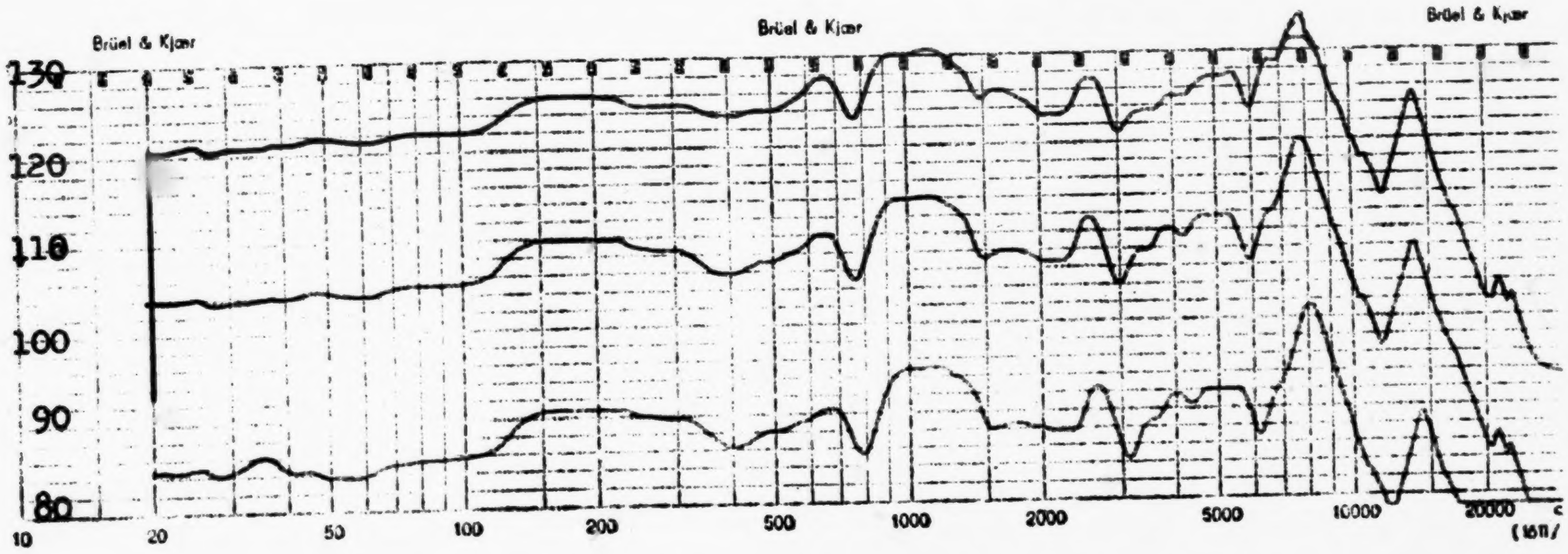


Figure 4 - Function of power output control. Input of 90 dB. Power output control set at 100 dB, 80 dB, 60 dB, volume control set at maximum. All filters set at zero attenuation.

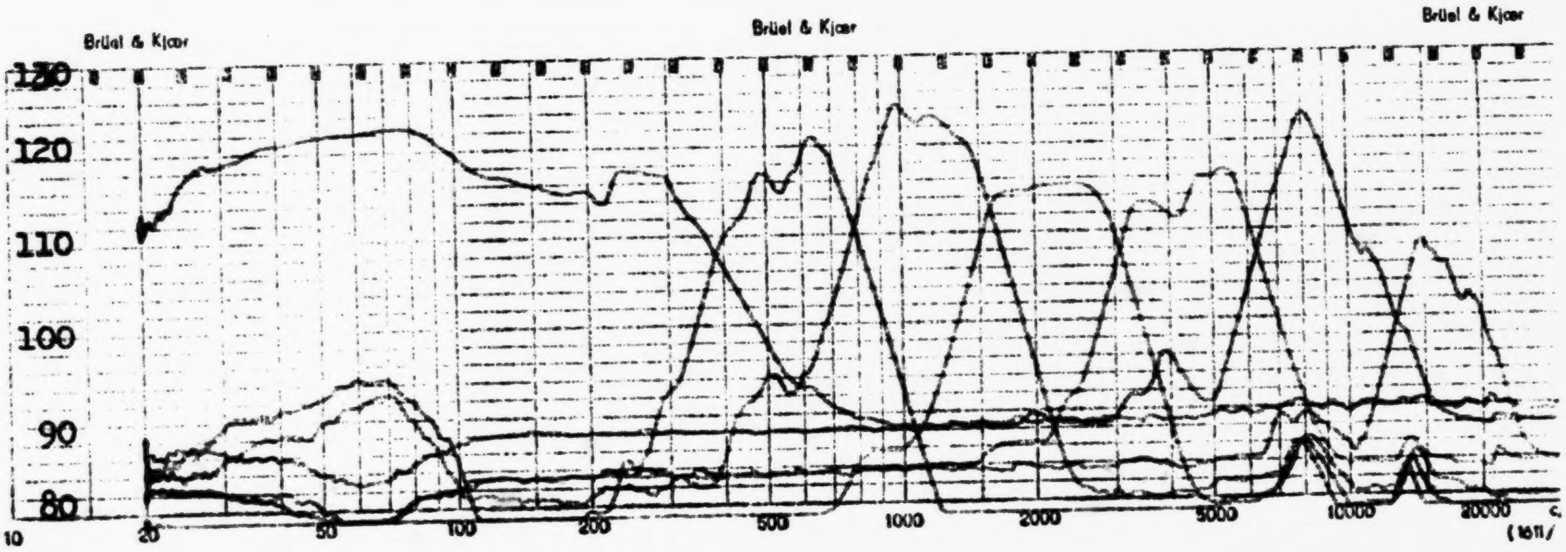


Figure 5 - Response characteristics of filters. Input of 60 dB. Power output control at 100 dB, volume control at maximum.

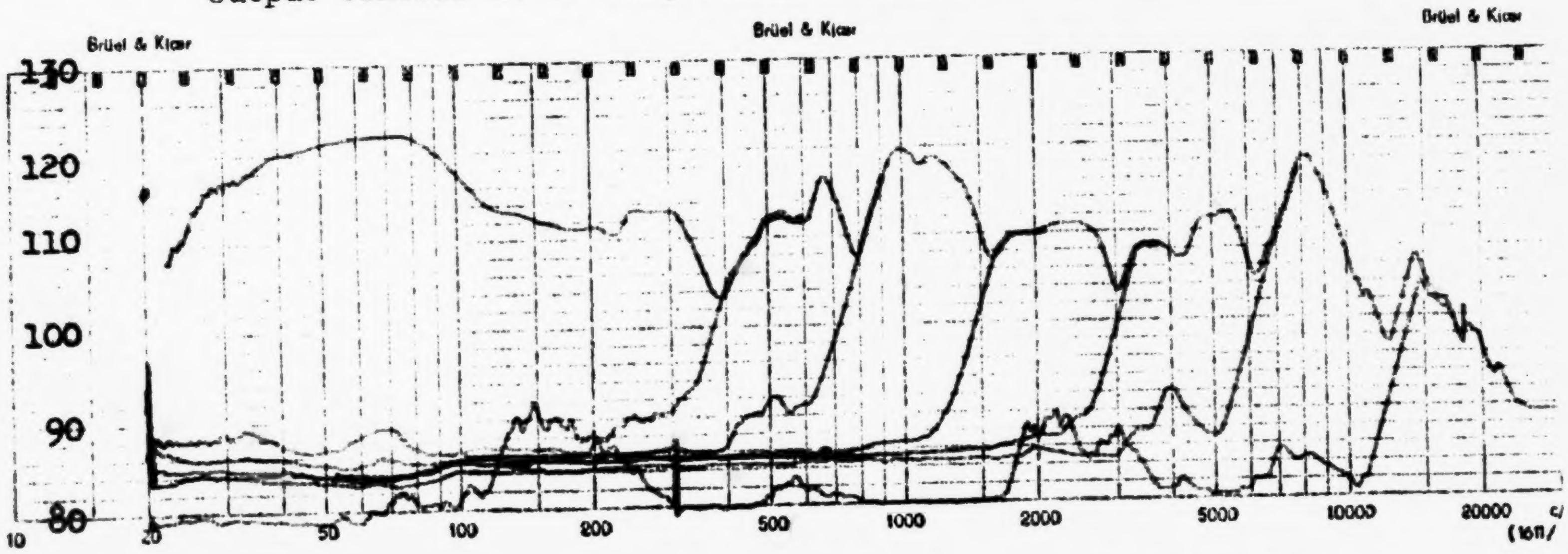


Figure 6 - Effect of moving attenuators to infinity in succession from 250 to 16000 Hz. Input of 60 dB. Power output control of 100 dB, volume control at maximum.

DEMAREE & ASSOCIATES

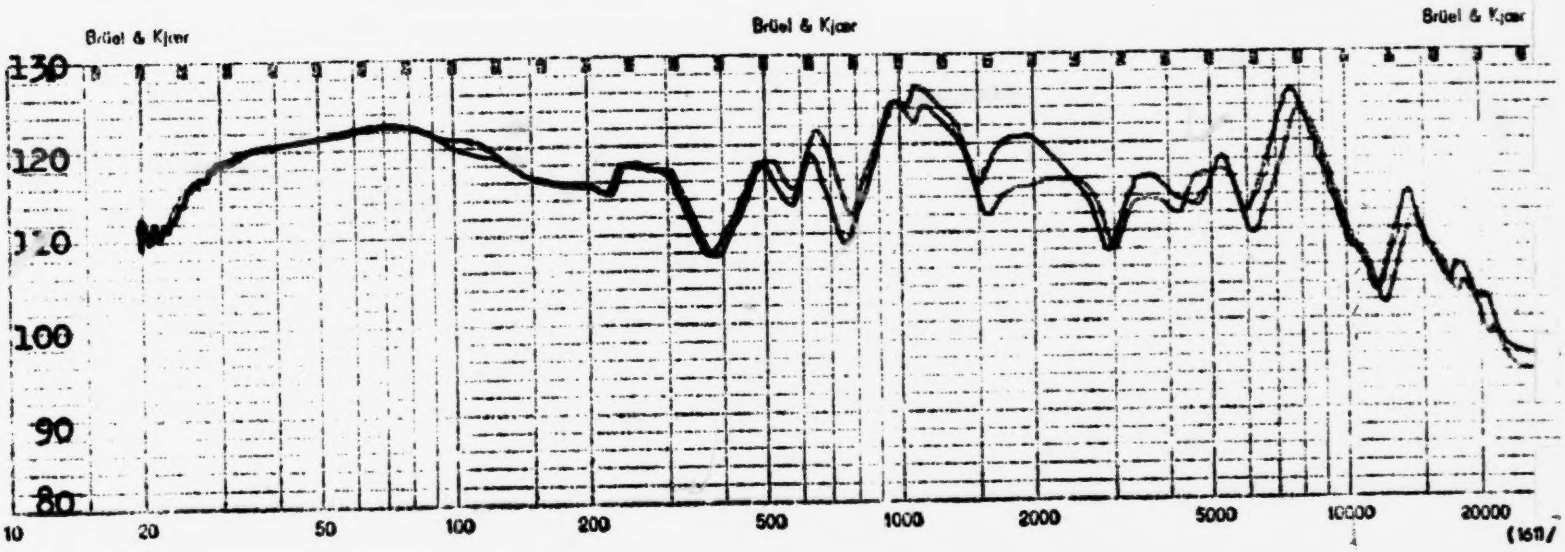


Figure 7 - Comparison of right and left earphone. Input of 60 dB. Power output control at 100 dB, volume control set at maximum.

QUALITY ASSURANCE

DEMAREE 1A

1. Enameled metal console face with sheet metal chassis. Fair service ability.
2. Controls are arranged well and adequately marked.
3. Components are adequately spaced but accessibility is limited by interconnecting wire restraints. Screws holding equipment panel under control panel are inaccessible.
4. Soldering and general workmanship are fair.
5. Parts are standard commercial type.
6. Service and maintainability aspects are fair.

EDUCATIONAL SURVEY

DEMAREE 1A

1. Physical Description

   This is a monaural auditory training unit. Its use is limited to a one-to-one basis, i.e., teacher and student in a tutorial setting. It is a fixed large unit using AC power. There is a movable teacher microphone. The headband is comfortable as are the muff covered headphones. The teacher is responsible for setting output at seven discrete frequencies and adjusting total volume. Audiogram templates can be made to facilitate settings for each child.

2. Quality

   See Quality Assurance for this unit.

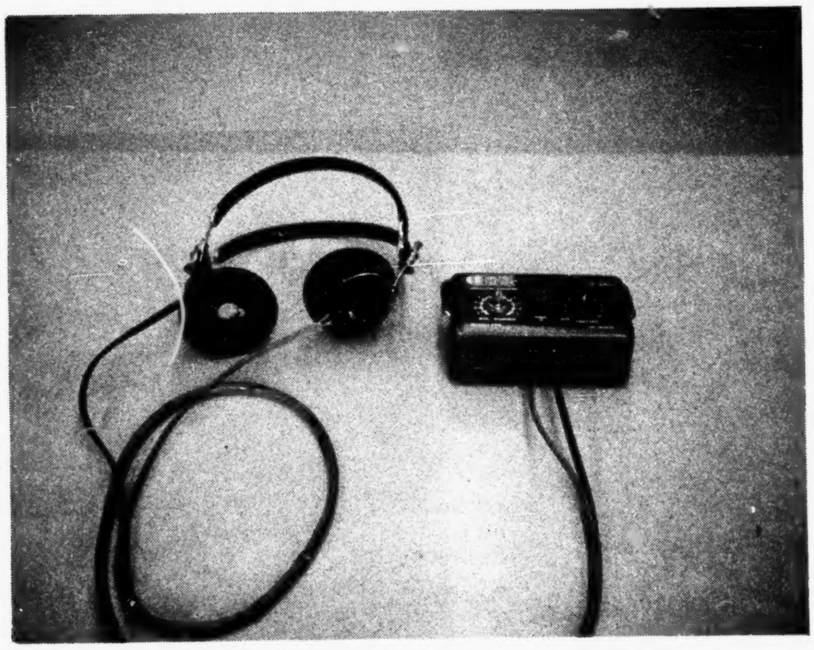
3. Performance

   Frequency response uniformity and harmonic distortion are unsatisfactory.

4. Educational Suitability

   Recommended for individual use only.

ECKSTEIN



AUDITORY TRAINER

ACOUSTICAL RESPONSE

ECKSTEIN 20

Frequency response uniformity, Figure 1, after the slope of the curve is established only one deviation of 5 dB between 400 and 500 Hz is recorded. The rest of the curve is fairly uniform until 4000 Hz is reached, at which point the roll off is smooth.

Frequency response uniformity using the insert earphone may also be considered as being good.

Harmonic distortion was low with 7% being registered at 1100 Hz, Figure 2.

Uniformity between channels was good and did not exceed 4 dB throughout the instruments effective range.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	59	100 - 6000	126

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 20

Note: Except where noted, the following curves were run using the TDH-39 earphones with the MX41AR cushion.

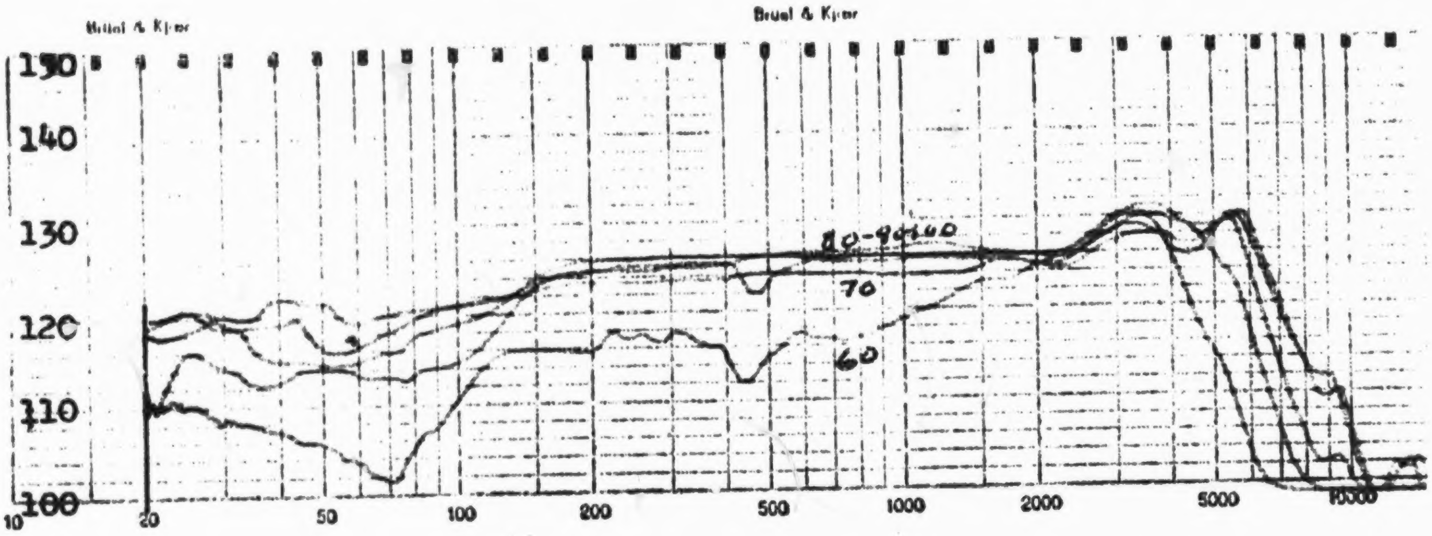


Figure 1 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB. Volume control set at maximum. Balance control set at zero. Tone switch set at normal.

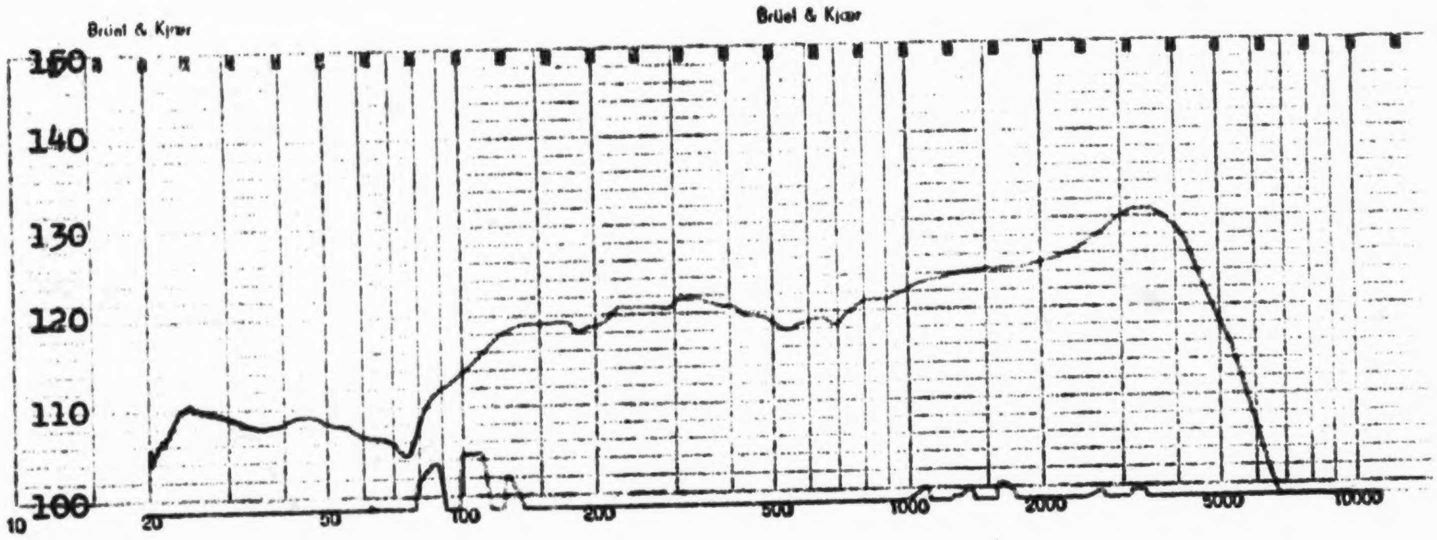


Figure 2 - Second Harmonic distortion at input of 70 dB. Volume control set 5 dB below maximum. Balance control set at zero. Tone control set at normal.

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 20

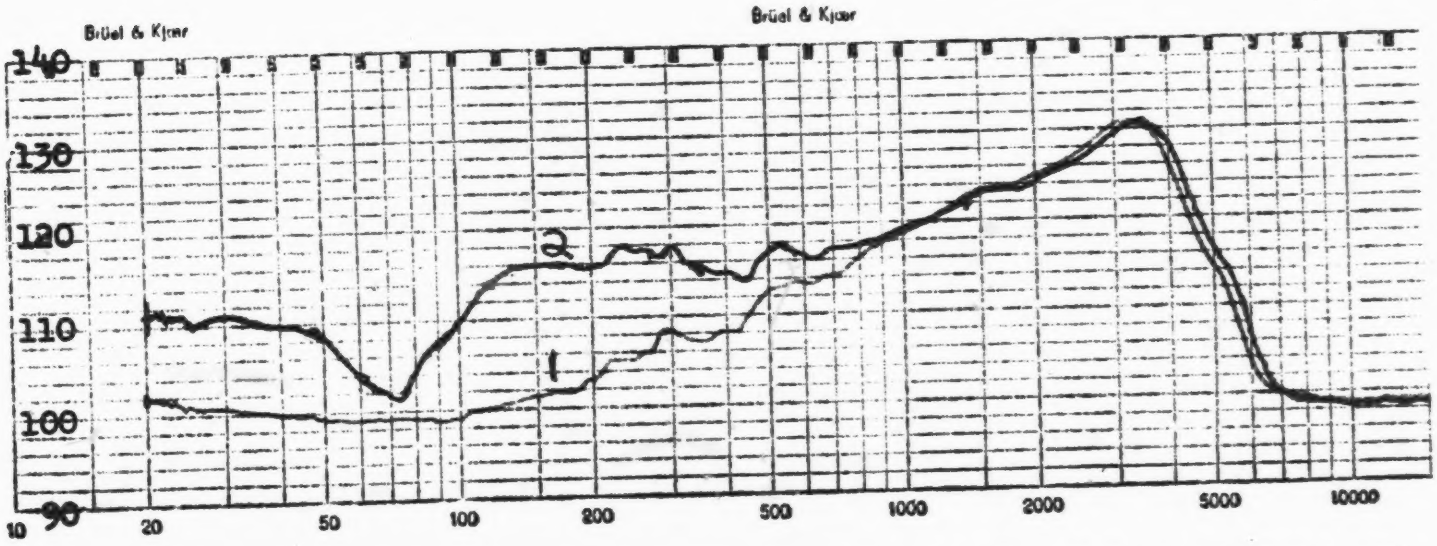


Figure 3 - Effect of tone control with input of 60 dB. Volume control set at maximum. Balance control set at zero. Tone switch set at high (curve 1) and normal (curve 2).

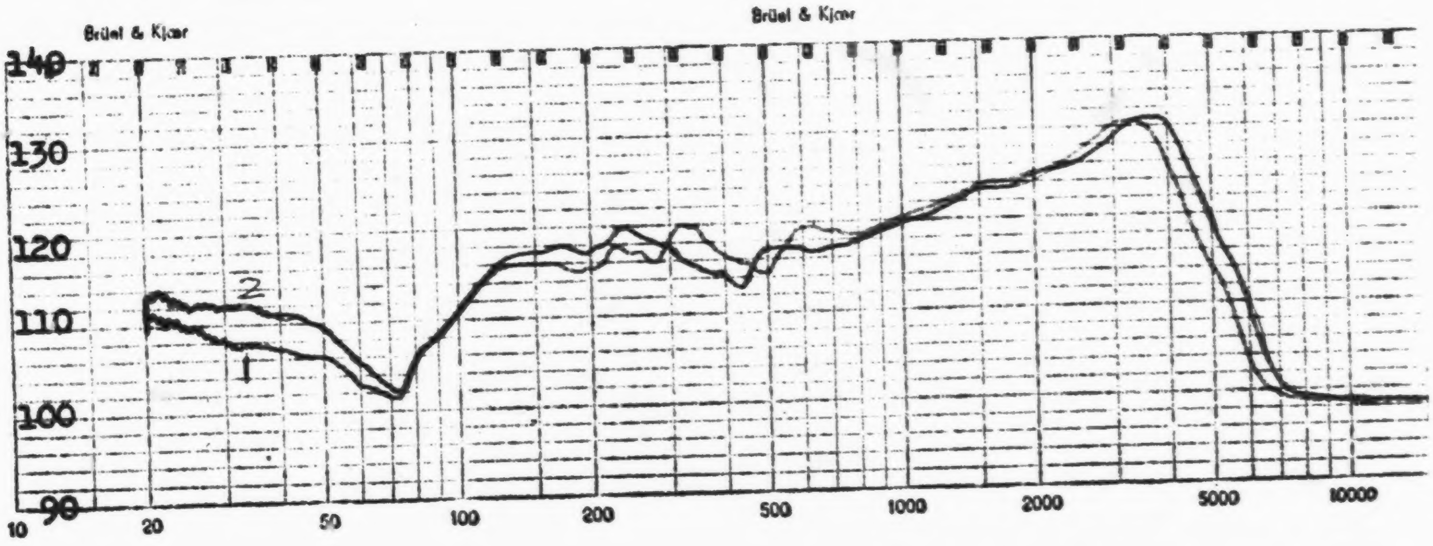


Figure 4 - Uniformity of channels with input of 60 dB. Volume control set at maximum, balance control set at zero. Tone switch set at normal. Curve 1 - right phone, Curve 2 - left phone.

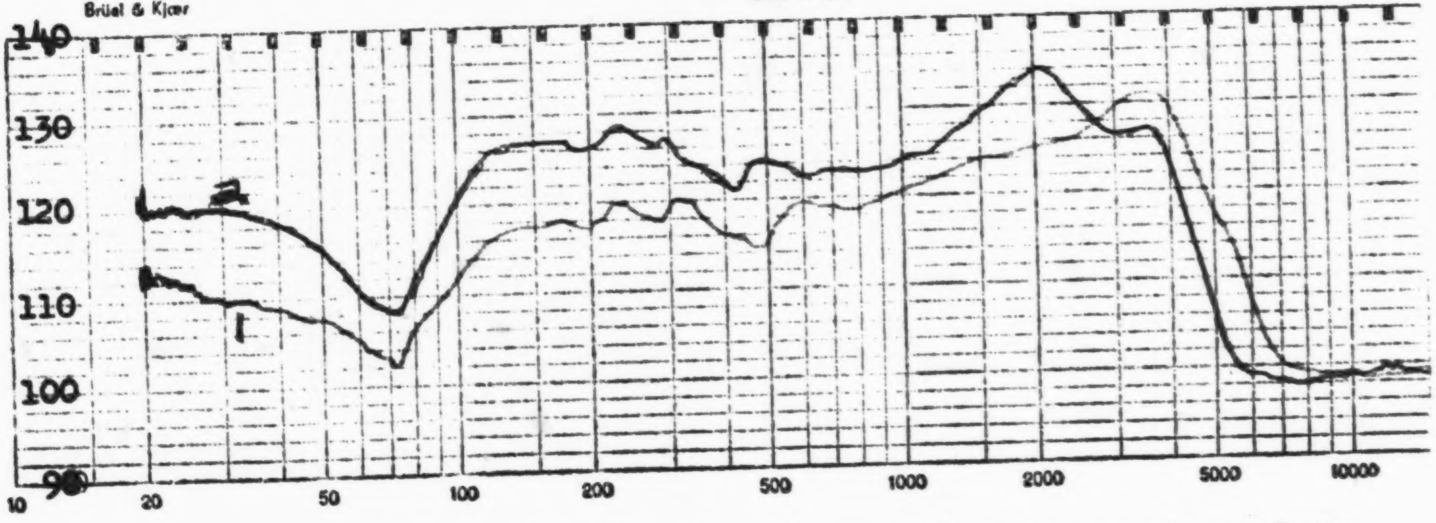


Figure 5 - Comparison of TDH-39 earphone (curve 1) with insert earphone (curve 2). Input of 60 dB. Volume control set at maximum. Balance control set at zero. Tone switch set at normal.

QUALITY ASSURANCE

ECKSTEIN 20

1. Metal case should provide good serviceability.

2. Control arrangement appears satisfactory but control markings are not distinctive enough to provide for ready selection of desired control setting.

3. Batteries are readily replaceable without soldering of wire leads. Corrosion is beginning to appear at battery terminals. General parts arrangement and wiring are good. However, mounting of chokes using glue leaves something to be desired.

4. Soldering and general workmanship are good. Parts are standard, commercial type.

5. Service and maintainability of this unit should be good.

EDUCATIONAL SURVEY

ECKSTEIN 20

1. Physical Description

Monaural transistor, self-contained portable unit with either cushion type earphones. Headbands vertically adjustable, but inflexible and uncomfortable. Insert receivers are available but cords are not durable. This is a portable unit and is student controlled.

2. Quality

The straight plug-in jack might be a source of trouble. A right angle jack might be a more satisfactory connection. Batteries are easily jarred out of position but can be easily replaced. This happens so frequently that maintenance is frequent. Battery replacement may be expensive.

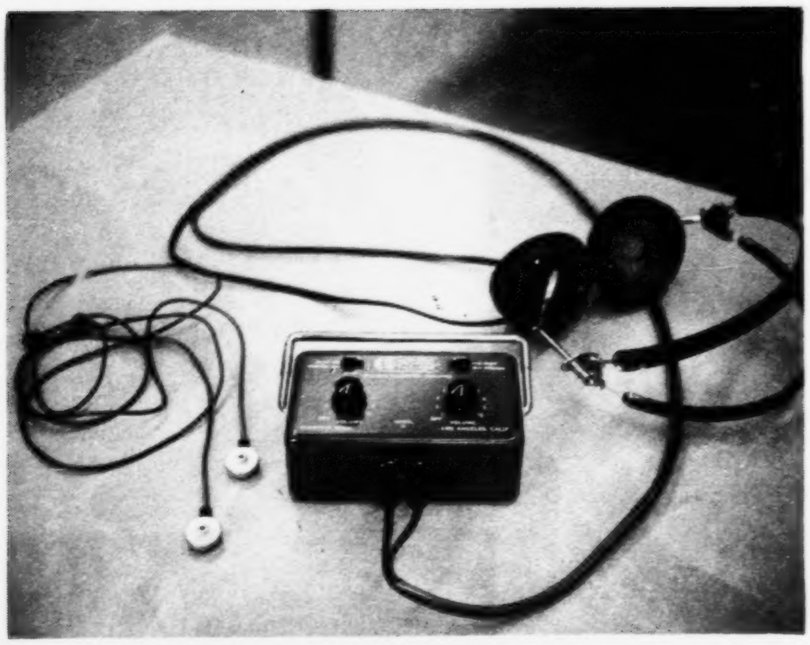
3. Performance

Nothing stated about performance.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

ECKSTEIN



AUDITORY TRAINER

ACOUSTICAL RESPONSE

ECKSTEIN 31

Frequency response uniformity, Figure 1. Response is fairly uniform for this unit when using the TDH 39 earphones up to 1000 Hz after which a sharp roll off occured at a rate of 12 dB per octave. A total of 16 dB change takes place before a sharp rise at 2400 Hz occurs. The rating in this case would be poor.

In the case of the insert earphone, Figure 5, a similar roll off was recorded with a total drop of 18 dB putting the instrument again into a poor rating category.

Harmonic distortion, Figure 2, was found to be very low in this particular model.

Tone control variability, Figure 3, was rated as good in keeping with our scale; however, it should be noted that virtually no change takes place except below 700 Hz.

Uniformity between channels was fair. Up to an 8 dB difference was recorded.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
insert earphone	66	100 - 3000	----
TDH 39 N earphone	56	100 - 6000	127

ECKSTEIN BROTHERS
BINAURAL AUDITORY TRAINER MODEL 31

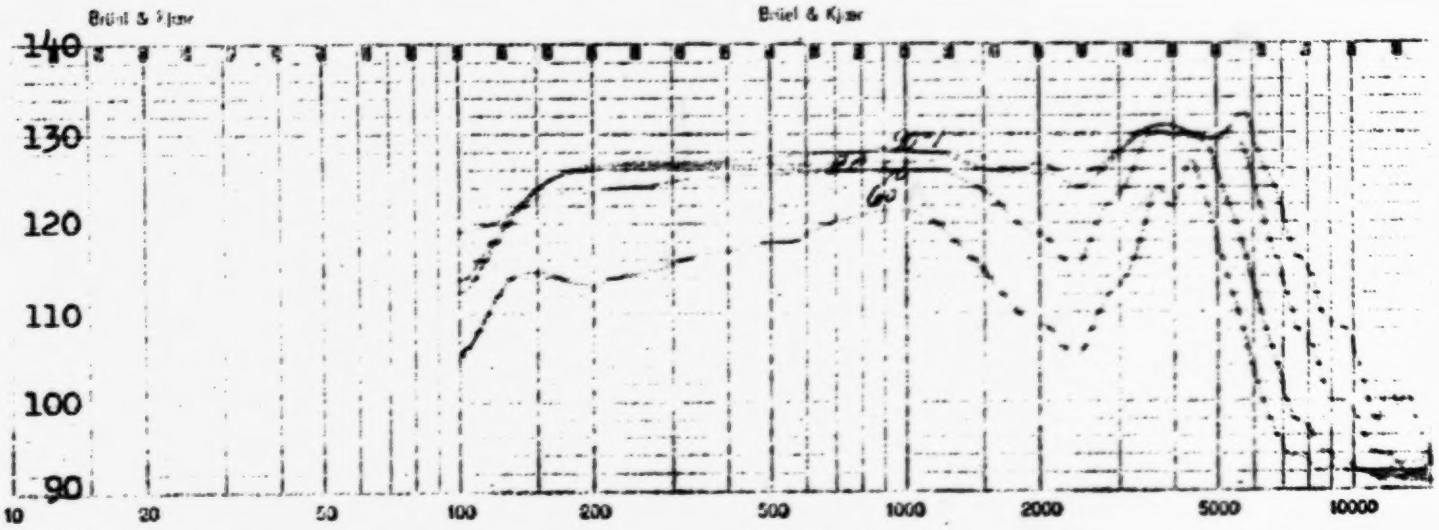


Figure 1 - Series of curves with inputs of 60, 70, 80, & 90 dB. Gain control set at maximum and tone control set at normal.

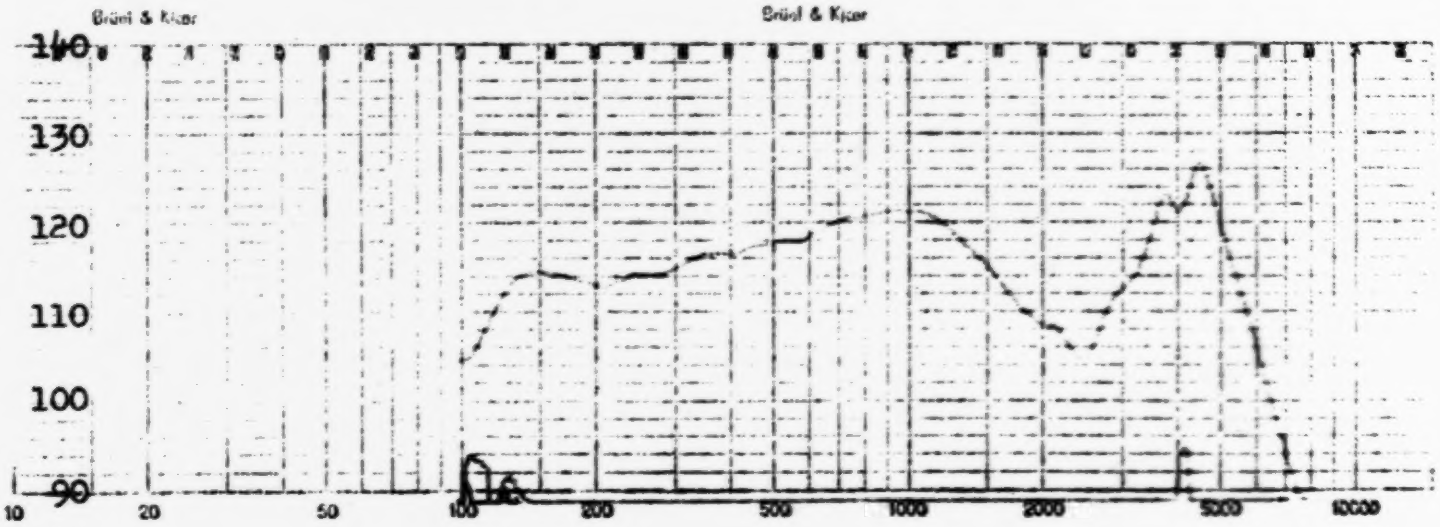


Figure 2 - Second harmonic distortion with an input of 70 dB. Gain control set at 5 dB below maximum and tone control set at normal.

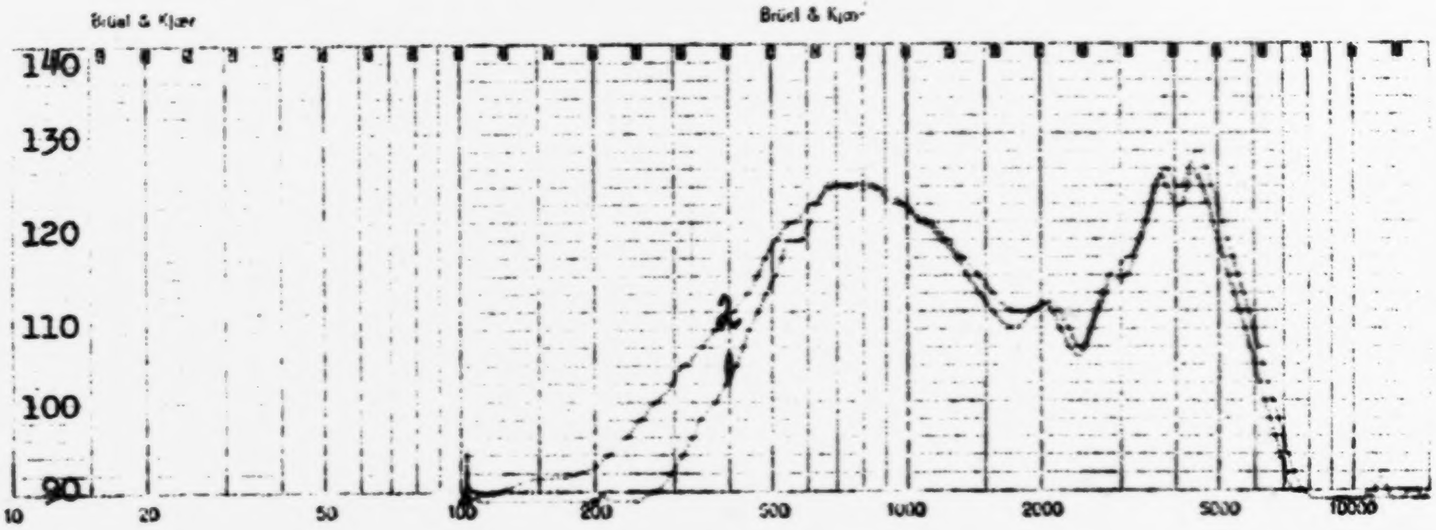


Figure 3 - Effect of tone control with an input of 60 dB. Volume control set at maximum. Tone control set at normal (curve 1) and at high (curve 2).

ECKSTEIN BROTHERS
BINAURAL AUDITORY TRAINER MODEL 31

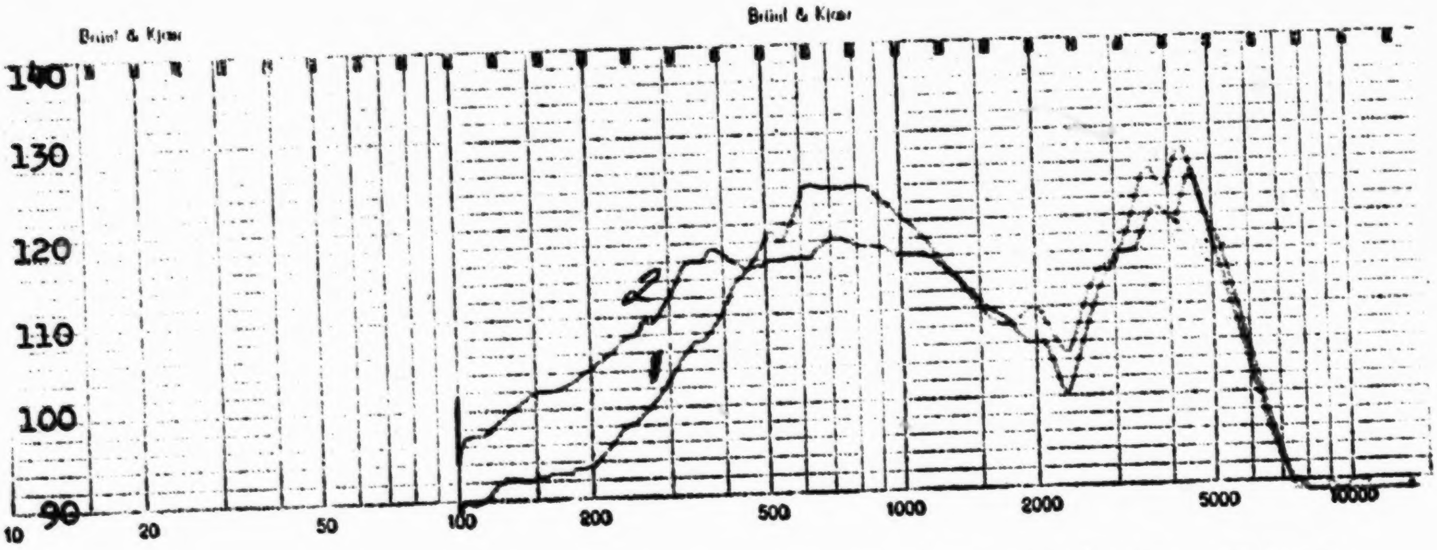


Figure 4 - Uniformity between channels with an input of 60 dB. Volume control set at maximum. Tone control set at normal. Curve 1 is right phone; curve 2 is left phone.

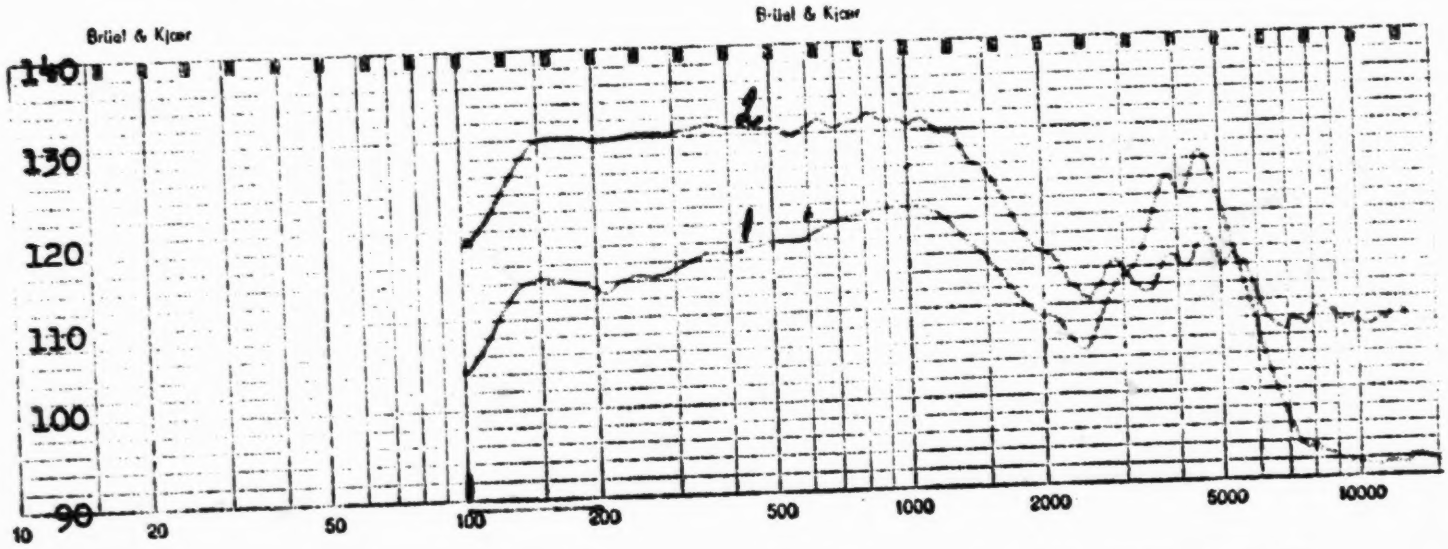


Figure 5 - Comparison of TDH 39 earphones (curve 1) with insert type earphone (curve 2). Input of 60 dB. Volume control set at maximum with tone control set at normal.

QUALITY ASSURANCE

ECKSTEIN 31

This unit was received too late to be evaluated for Quality Assurance.

EDUCATIONAL SURVEY

ECKSTEIN 31

1. Physical Description

Eckstein model 31 is a binaural transistor amplifier with cushion type earphones. Headbands are vertically adjustable but inflexible and uncomfortable. Insert receivers are optional, but cords are not durable. This is a self contained portable unit, with student controls allowing unlimited mobility. It is DC powered with replaceable but not rechargeable batteries. Student microphones are built into the unit.

2. Quality

The straight plug-in jack might be a source of trouble. A right angle jack might be a more satisfactory connection. Batteries are easily jarred out of position but can be easily replaced. This happens so frequently that maintenance is frequent. Battery replacement may be expensive.

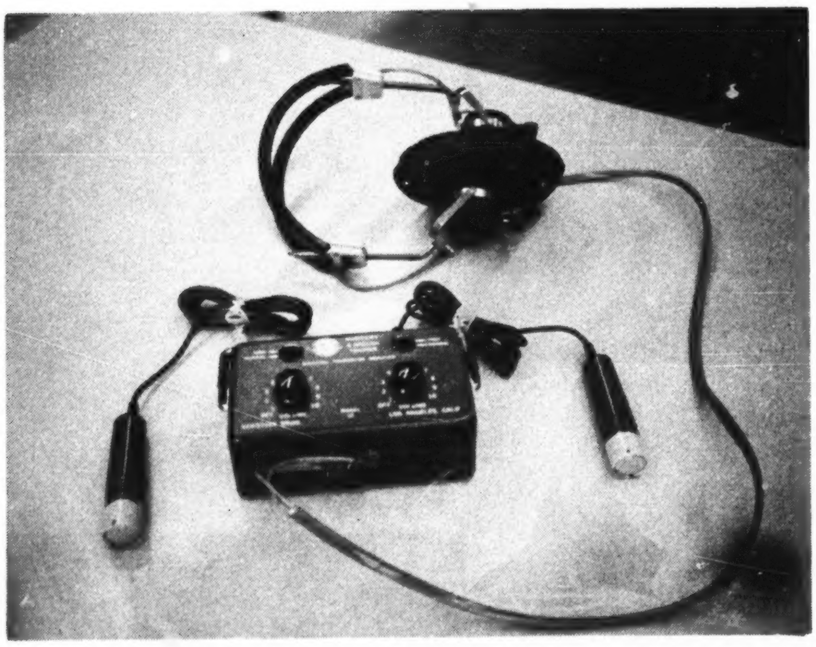
3. Performance

Nothingstated about performance of this unit.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

ECKSTEIN



AUDITORY AND SPEECH TRAINER

ACOUSTICAL RESPONSE

ECKSTEIN 32

Frequency response uniformity, Figure 1, using TDH 39 earphones with MX41AR cushions, was rated as excellent as only a 5 dB variation occured after the curve slope was established. However, it is felt in this study that a negative slope in the highs,as shown here, is not very desirable.

Frequency response uniformity, Figure 5, using insert earphones is excellent except that the same complaint as registered about Figure 1 is more evident here.

The internal microphone provided a much more acceptable slope from an audiological point of view. (see Figure 7.)

Harmonic distortion was found to be very low throughout the effective frequency range for both types of earphones and microphones.

Tone control variability, Figure 3, is good below 500 Hz but only fair between 500 and 1000 Hz; the overall rating is therefore only fair.

Uniformity between channels, Figure 4, was found to vary as much as 7 dB giving a fair rating.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C earphone	43	100 - 8000	128
insert earphone	55	100 - 3500	138

ECKSTEIN BROTHERS
Model 32

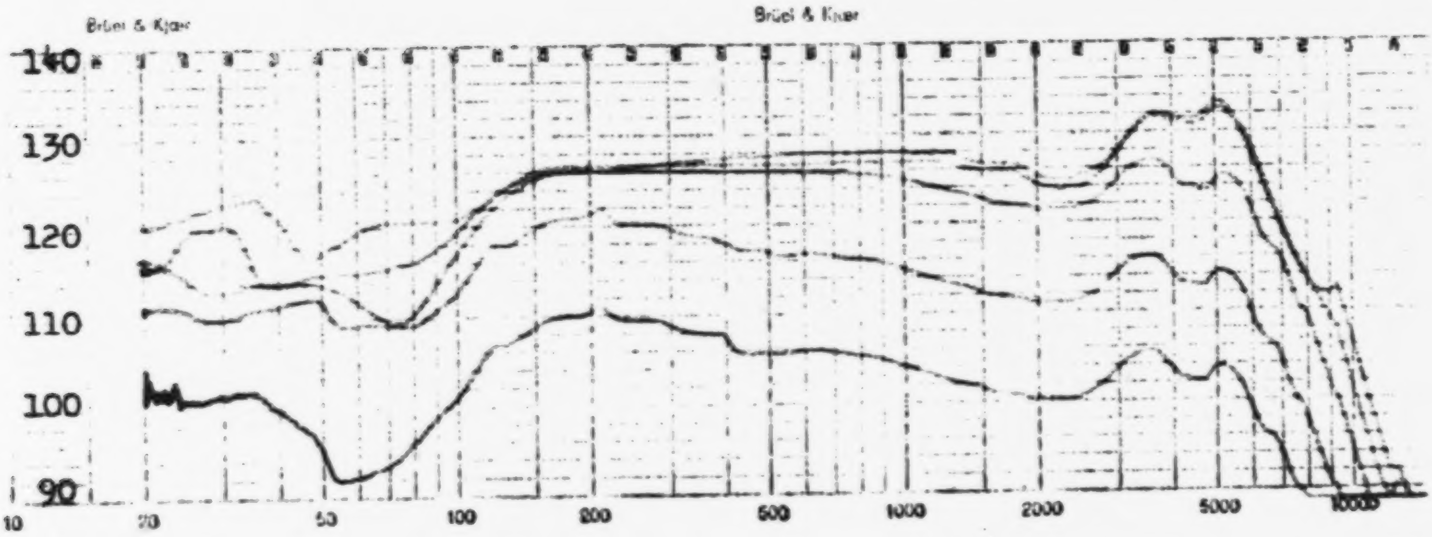


Figure 1 - Series of curves using external mic. with inputs of 60, 70, 80, 90, & 100 dB. Gain control set at maximum and tone control set at normal. TDH 39 earphone used.

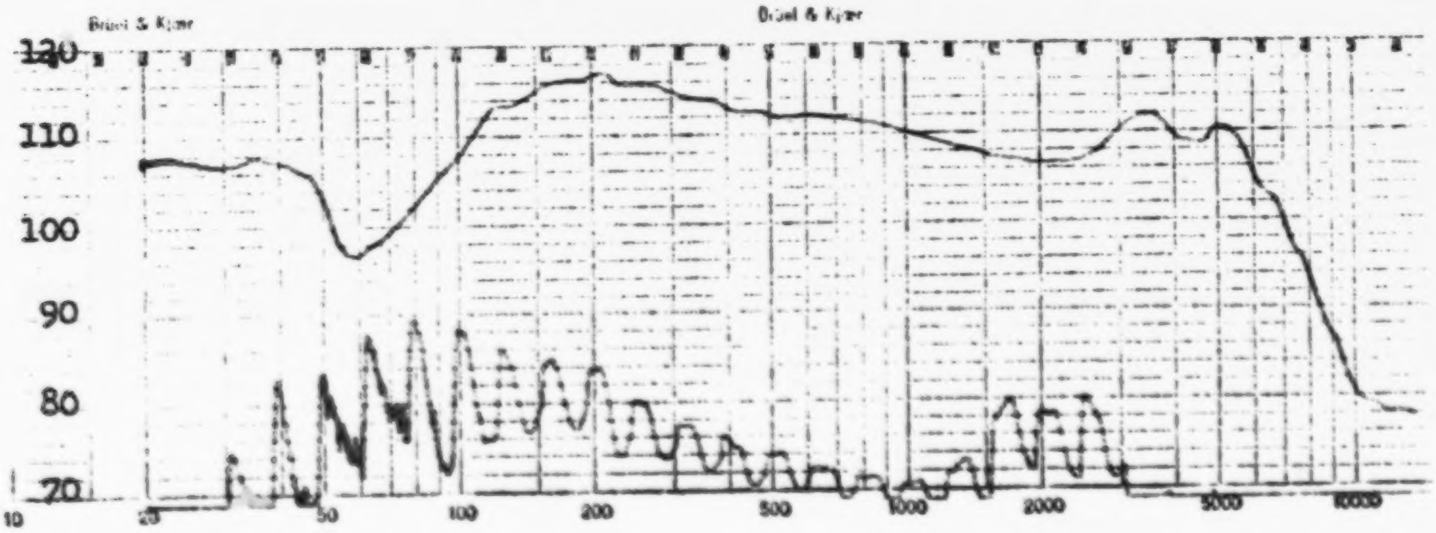


Figure 2 - Second harmonic distortion using external mic. with an input of 70 dB. Gain control set at 5 dB below maximum and tone control set at normal. TDH 39 earphone used.

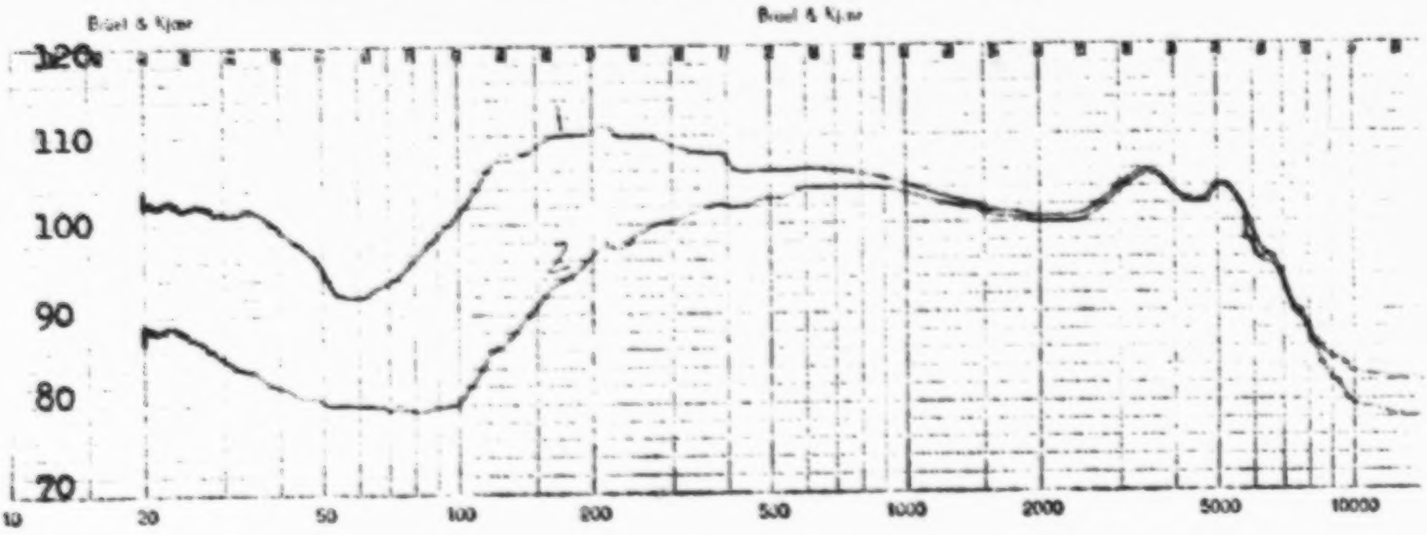


Figure 3 - Effect of tone control, using external mic. with an input of 60 dB. Gain control set at maximum and tone control set at normal (curve 1) and high (curve 2). TDH 39 earphone used.

ECKSTEIN BROTHERS
Model 32

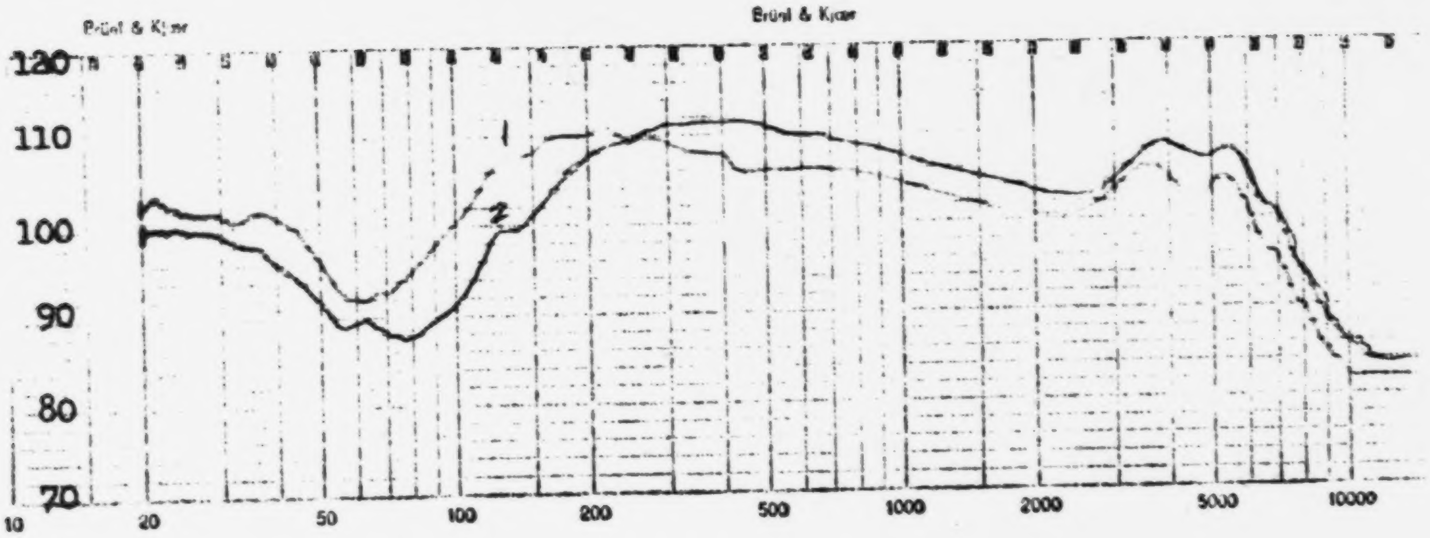


Figure 4 - Uniformity between channels using external mic. with an input of 60 dB. Gain control set at maximum and tone control set at normal. TDH 39 earphone used.

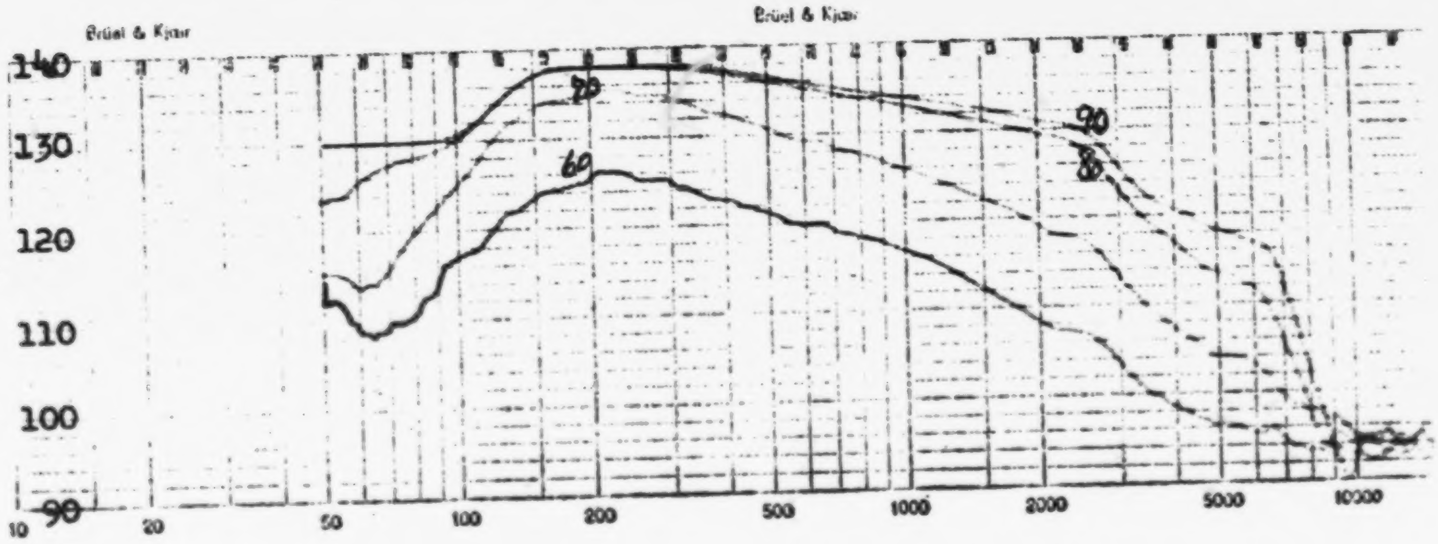


Figure 5 - Series of curves with inputs of 60, 70, 80, & 90 dB. Volume control set at full and tone control set at normal, using external mic. and insert type earphones.

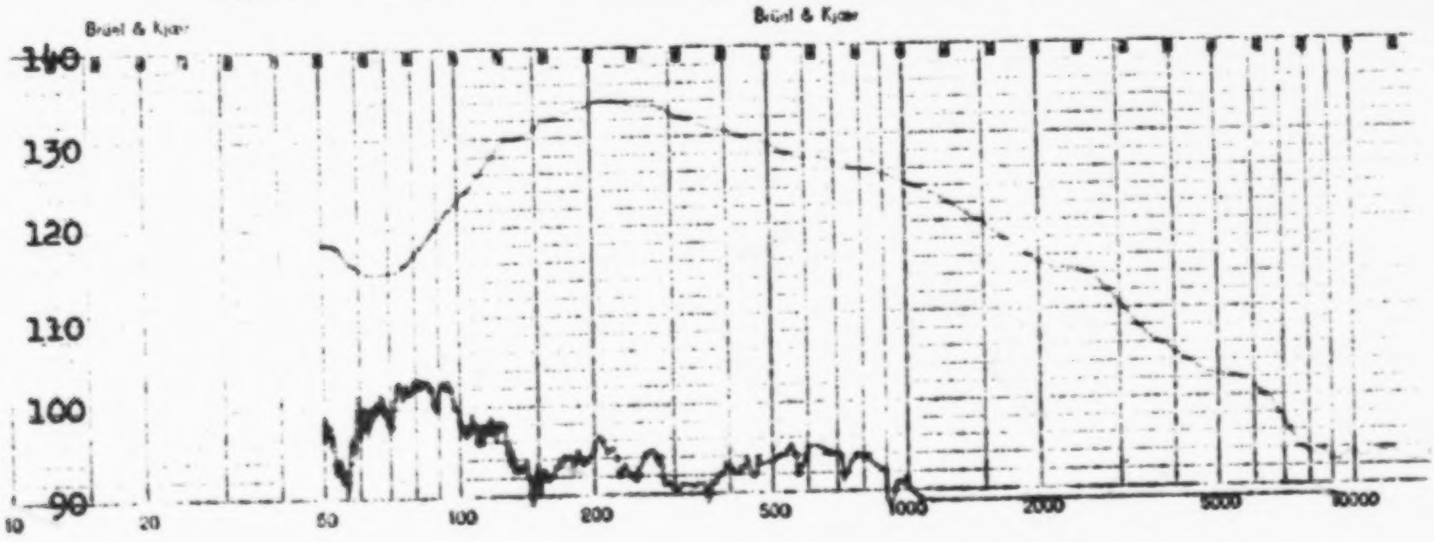


Figure 6 - Second harmonic distortion with an input of 70 dB. Volume control set at 5 dB below maximum and tone control set at normal, using external mic. and inser type earphones.

ECKSTEIN BROTHERS
Model 32

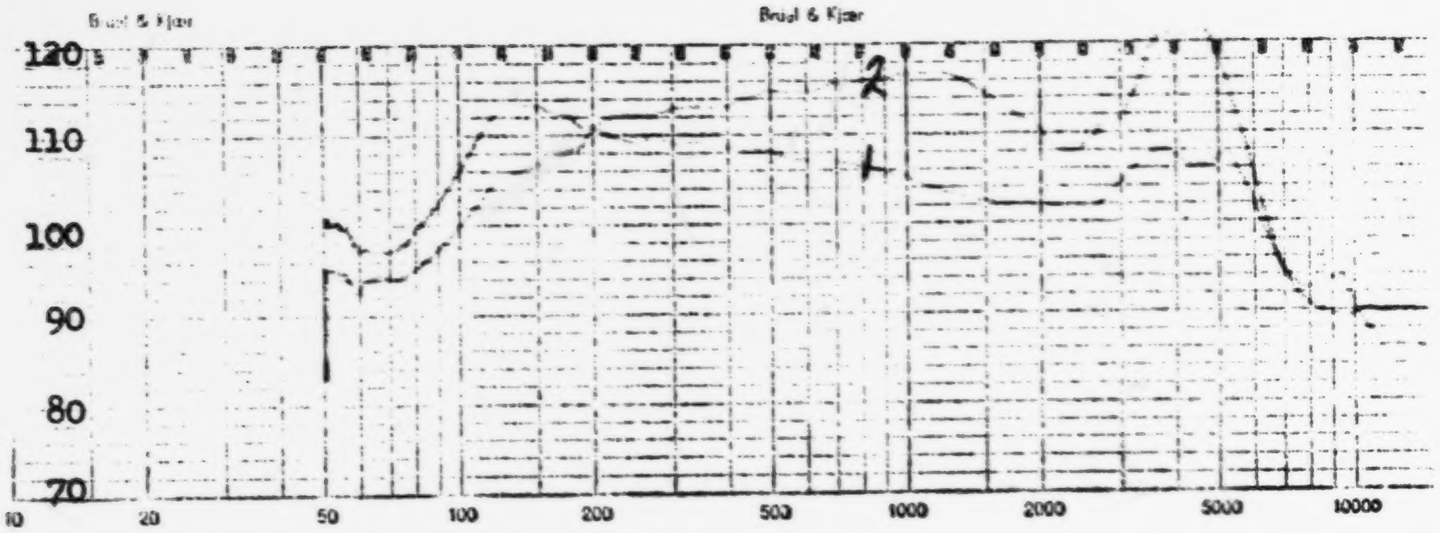


Figure 7 - Comparison of external and internal microphones with an input of 60 dB. Volume control set at maximum and tone control set at normal, using TDH 39 earphones. Curve 1 - external mic.; Curve 2 - internal mic.

QUALITY ASSURANCE

ECKSTEIN 32

This unit was received too late to be evaluated for Quality Assurance.

EDUCATIONAL SURVEY

ECKSTEIN 32

1. Physical Description

   This is a self contained portable unit with external microphones as well as two internal microphones. Student regulates dial controls.

2. Quality

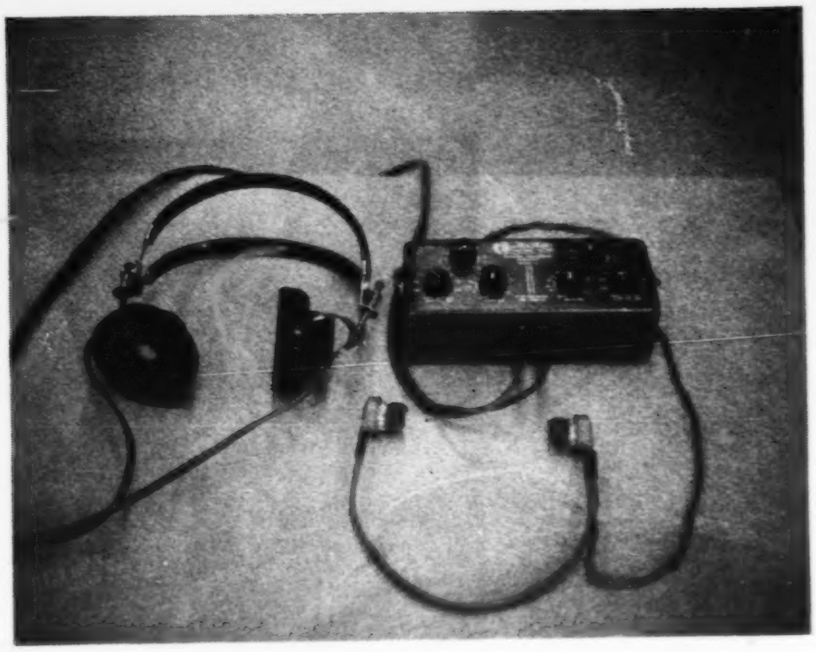
   The straight plug-in jack might be a source of trouble. A right angle jack might be a more satisfactory connection.

3. Performance

   See Acoustical Response section on this unit.

4. Educational Suitability

   This instrument should not be used with external microphones with any hearing impaired child.



AUDITORY TRAINER

ACOUSTICAL RESPONSE

ECKSTEIN 33

Frequency response uniformity, Figure 1, is rated as fair. After 1000 Hz the curve drops sharply by 8 dB then continues to drop in lesser steps to 3000 Hz where it becomes rather jagged out to 5000 Hz. In Figure 8, the response of an insert earphone can be seen. The 15 dB drop off between 2000 Hz and 3000 Hz maintains a rating of fair.

Harmonic distortion, Figure 2 and Figure 2C, shows second harmonic distortion was only 9% at its highest point. The third harmonic distortion registered 40% at 1200 Hz giving this instrument a rather poor rating.

Effect of tone control, Figure 3. This is a continuous control which exerts an excellent change over the tone. However, the calibrated scale did not relate to the acoustic changes.

Gain control calibration, Figure 4. The gain control taper did not relate in any reasonable manner to the calibrated scale found on the dial plate.

Output limiter control calibration, Figure 5. In this case, the changes per step were good and in line with the changes on the dial plate; however, the calibration was off by as much as 13 dB.

Uniformity between channels, Figure 6, was fair with separations as great as 7 dB.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 C	66	150 - 6000	125

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 33

Note: Except where noted, the following curves were run using the TDH-39 earphones with the MX41AR cushion.

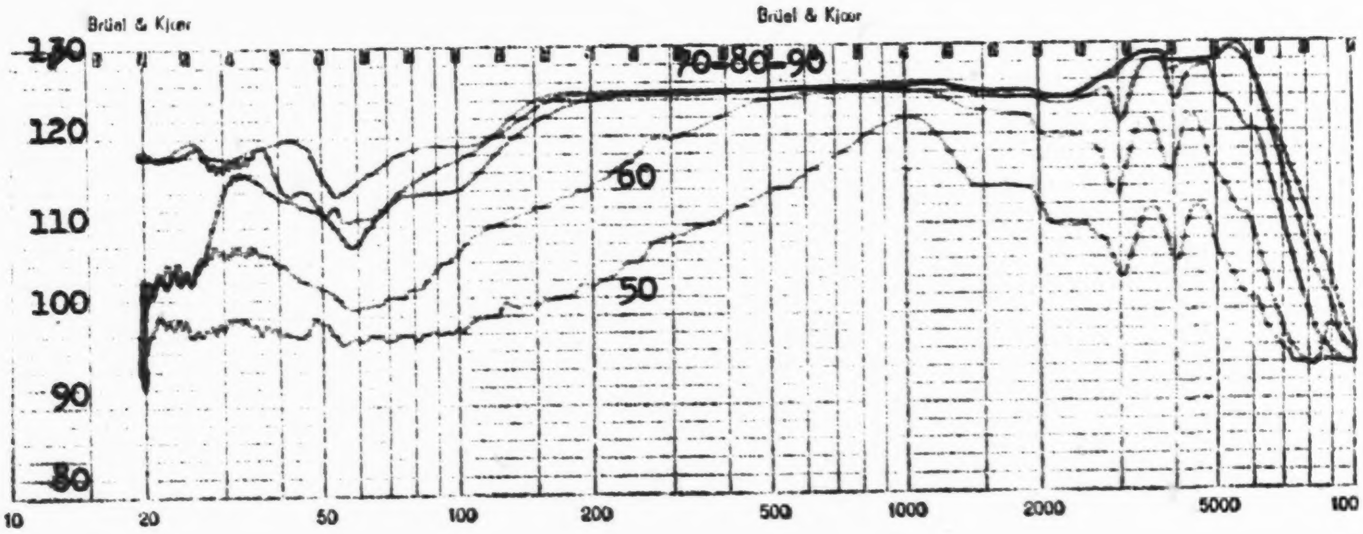


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, & 90 dB. Gain control and maximum output limiter set at maximum. Tone control set at flat.

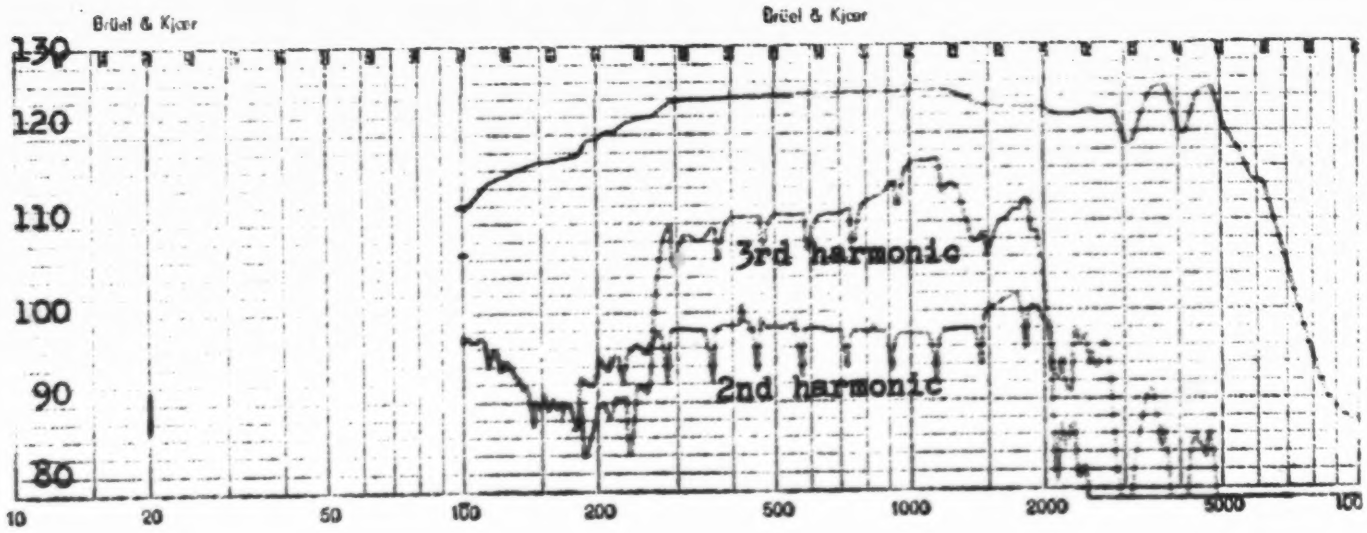


Figure 2 - Second and third harmonic distortion with input of 70 dB. Gain control 5 dB below maximum output. Maximum output limiter set at 135 dB.

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 33

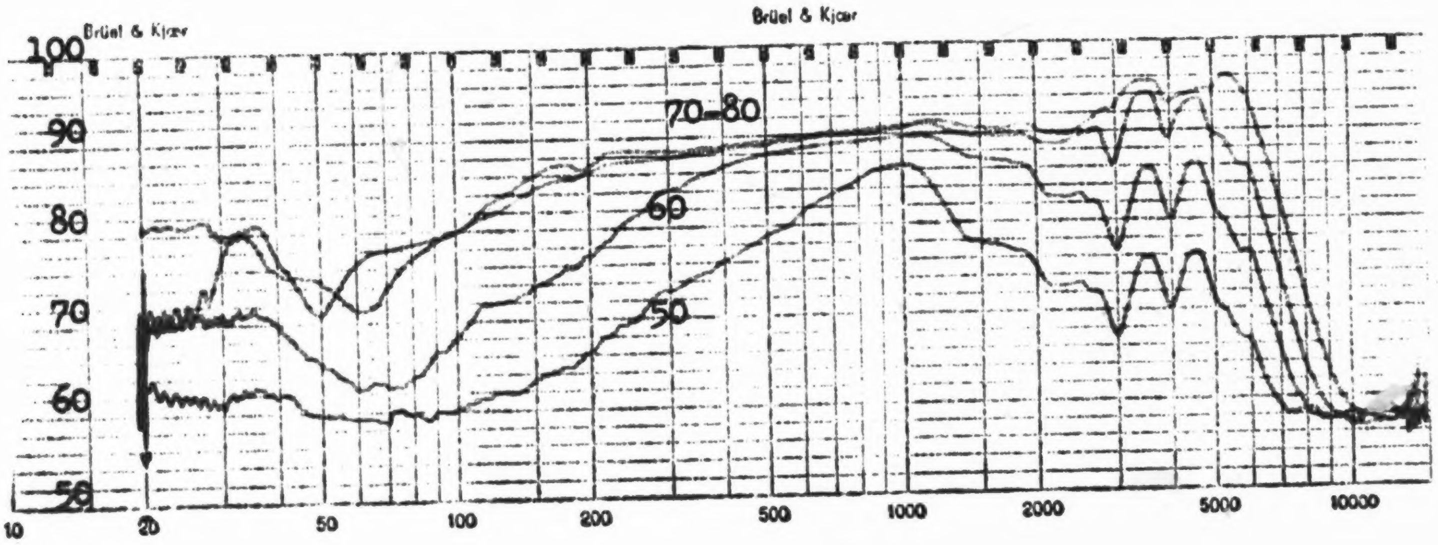


Figure 2B - Series of curves with inputs of 50, 60, 70, & 80 dB. Gain control set at maximum. Maximum output limiter set at 110 dB. Tone control set at flat.

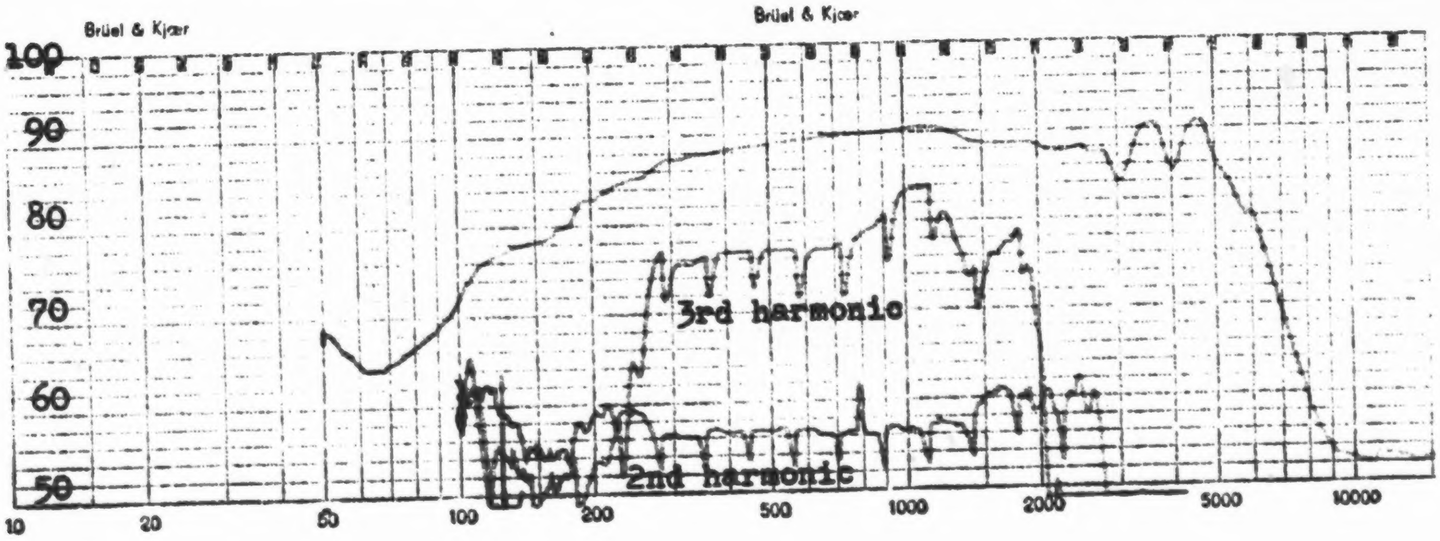


Figure 2C - Second and third harmonic distortion with input of 70 dB. Gain control set at 5 dB below maximum. Maximum output limiter set at 110 dB.

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 33

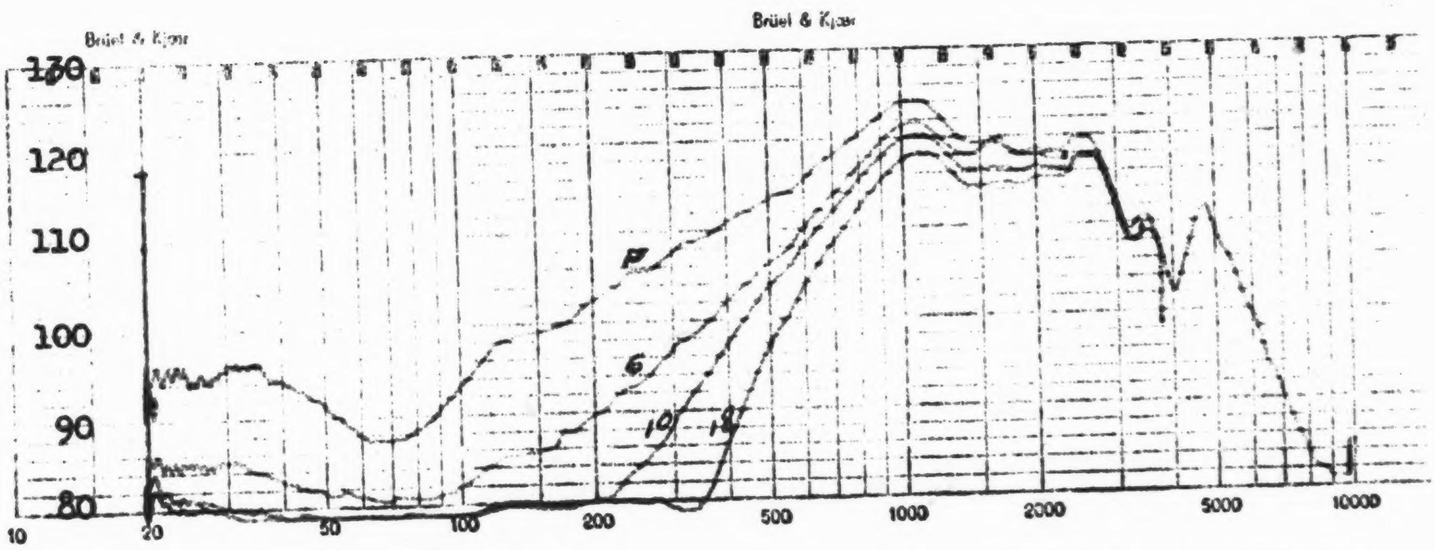


Figure 3 - Effect of tone control with input of 60 dB. Gain control set at 65 dB. Maximum output limiter set at 135 dB. Tone control set at flat, 6, 10, and 18.

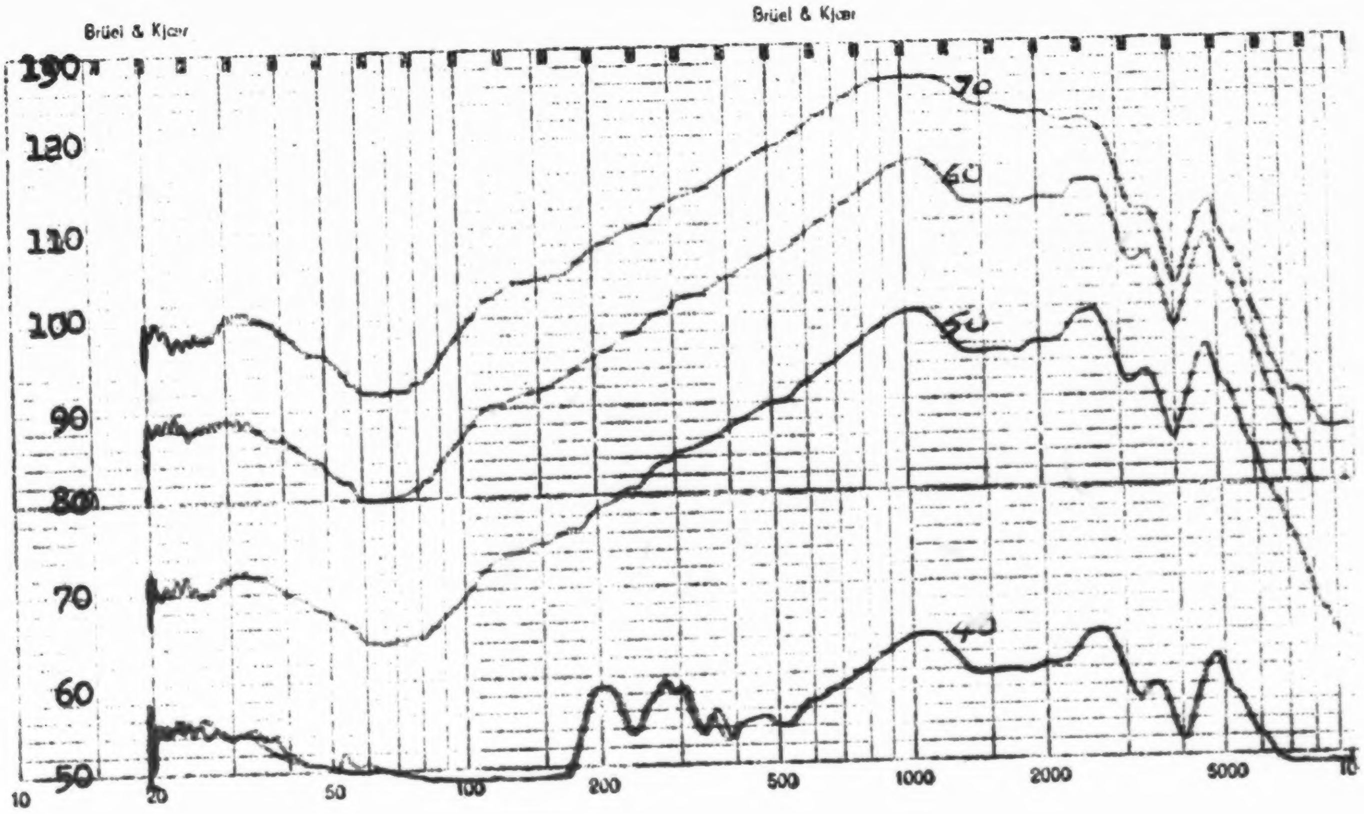


Figure 4 - Effect of gain control with input of 60 dB. Gain control set at 40, 50, 60, & 70 dB. Maximum output limiter set at 135 dB. Tone control set at flat.

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 33

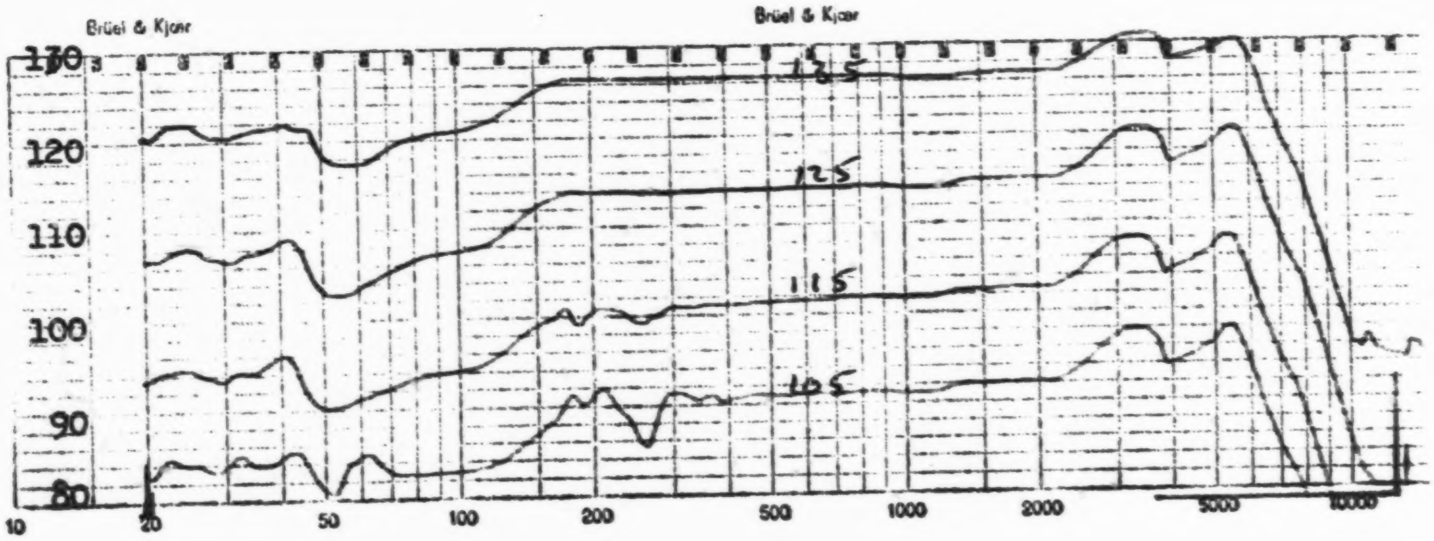


Figure 5 - Effect of maximum output limiter control with input of 90 dB. Gain control set at 75 dB. Tone control set at flat. Maximum output limiter set at 105, 115, 125, & 135 dB.

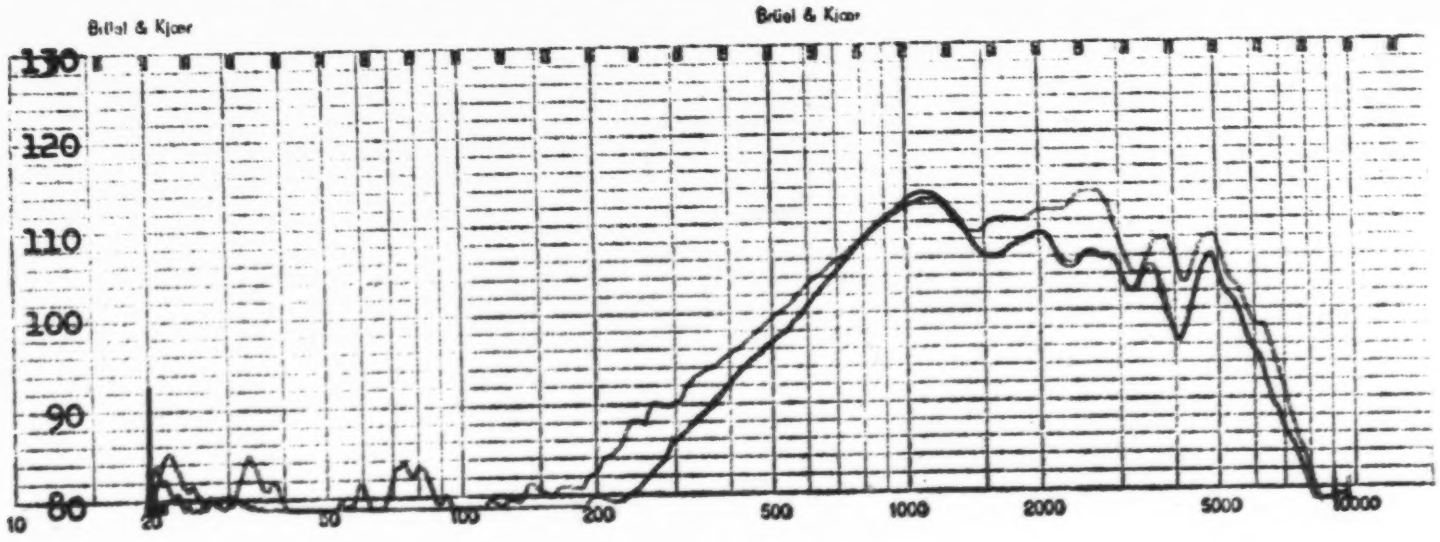


Figure 6 - Uniformity between channels with input of 60 dB. Gain setting of 60 dB and tone setting of 8. Maximum output limiter set at 135 dB.

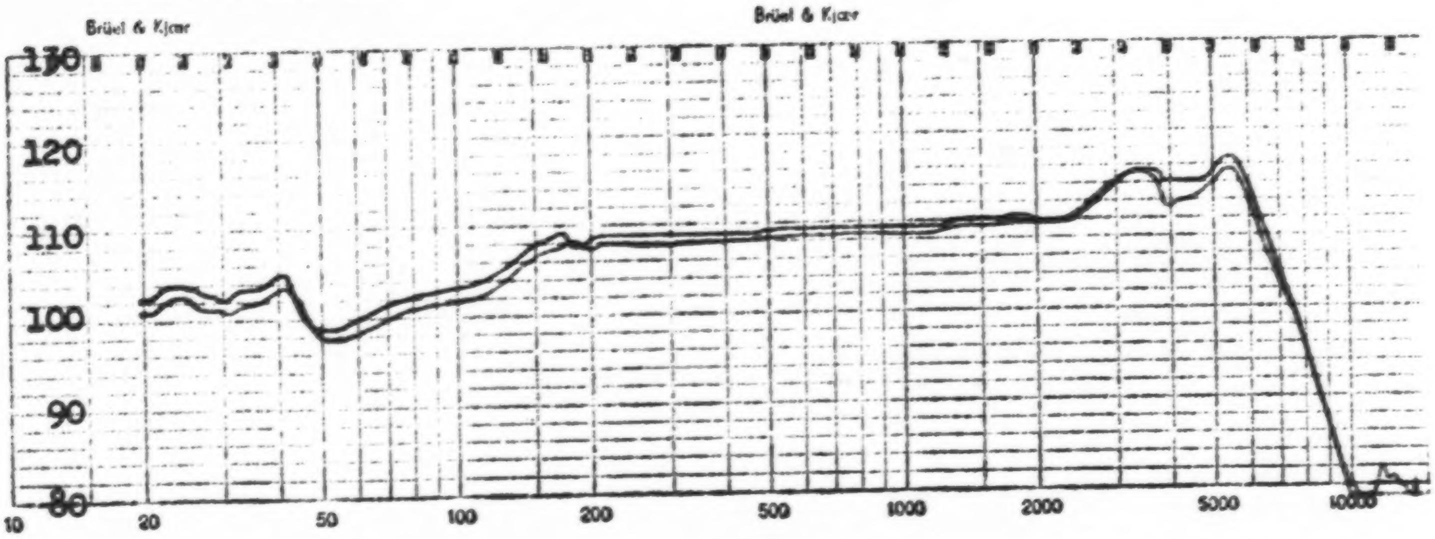


Figure 7 - Uniformity between channels with input of 90 dB. Gain control set at 75 dB. Maximum output limiter set at 120 dB. Tone control set at flat.

ECKSTEIN BROTHERS
AUDITORY TRAINER MODEL 33

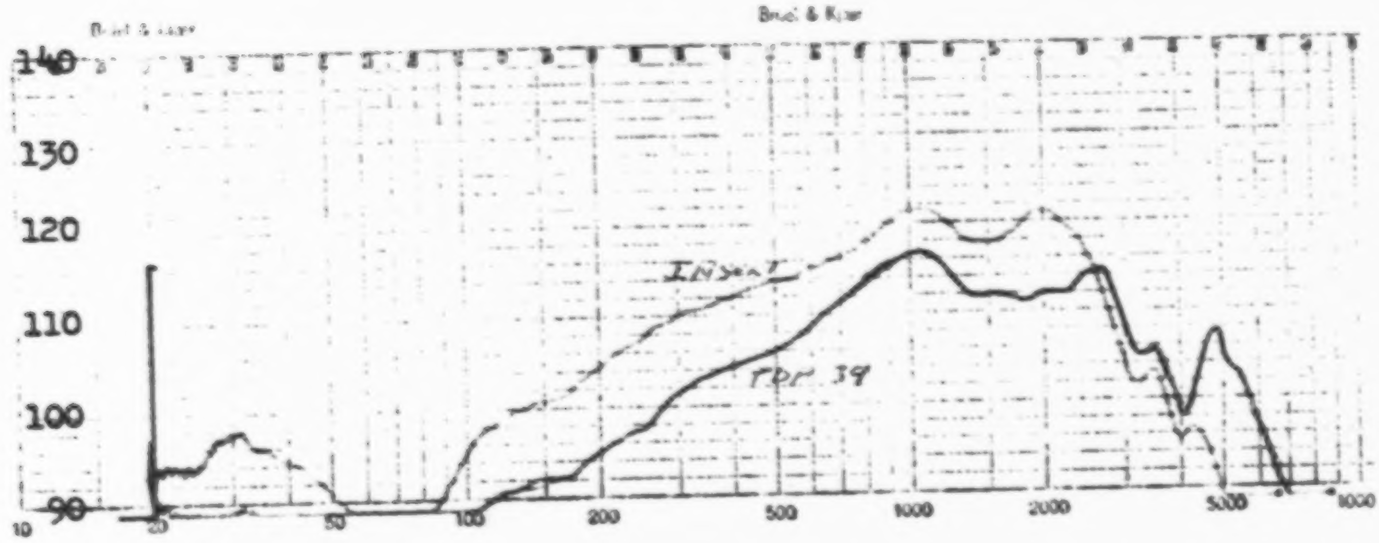


Figure 8 - Comparison of insert type earphone and TDH-39 type earphone. Input of 60 dB. Gain control set at 60 dB. Maximum output limiter control set at 135 dB. Tone control set at flat.

QUALITY ASSURANCE

ECKSTEIN 33

1. Metal case should provide good serviceability.
2. Control arrangement appears satisfactory but control markings are not distinctive enough to provide for ready selection of desired control setting.
3. Batteries are readily replaceable without unsoldering of wire leads. Corrosion is beginning to appear at battery terminals. General parts arrangement and wiring are good. However, mounting of chokes using glue, leaves something to be desired.
4. Soldering and general workmanship are good. Parts are standard commercial type.
5. Service and maintainability of this unit should be good.

EDUCATIONAL SURVEY

ECKSTEIN 33

1. Physical Description

A binaural transistor, self contained, portable amplifier with cushion type earphones. Headbands are vertically adjustable, but inflexible and uncomfortable. Inserts are optional. Cords are not durable. This portable unit allows unlimited mobility. It is DC powered with replaceable, but not rechargeable batteries. Student microphones are built in. Teacher regulates tone control and maximum output control; students adjust gain control.

2. Quality

The straight plug-in jack might be a source of trouble. A right angle jack might be a more satisfactory connection. Batteries are easily jarred out of position but can be easily replaced. This happens so frequently that maintenance is frequent. Battery replacement may be expensive.

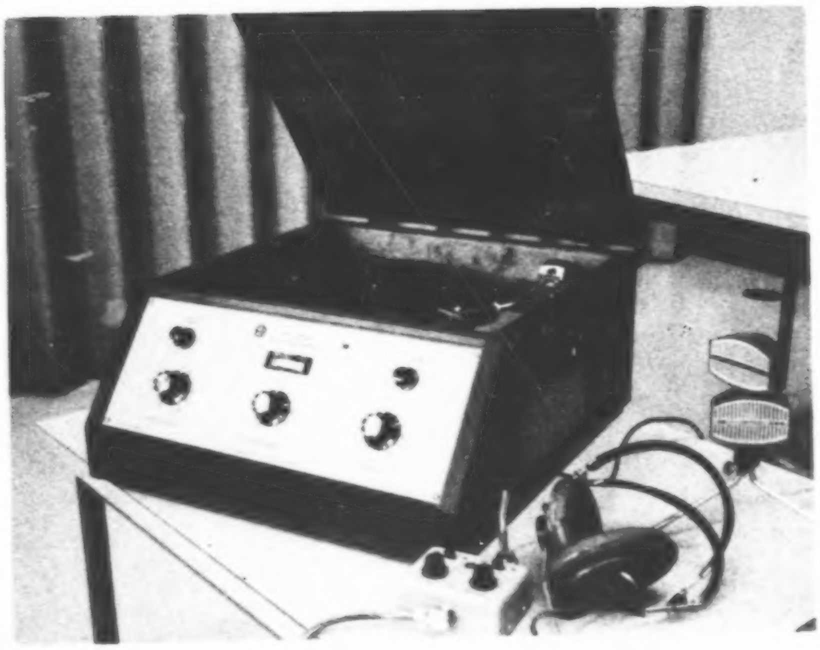
3. Performance

Harmonic distortion and control calibration are unsatisfactory.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

ECKSTEIN



AUDITORY TRAINER

ACOUSTICAL RESPONSE

ECKSTEIN 38

Frequency response uniformity, Figure 1, shows that the curve uniformity is good up to 2000 Hz where a 24 dB increase in gain occurs between 2200 Hz and 4500 Hz. For this instrument a rating of poor would have to be applied.

Harmonic distortion, Figure 2, was found to be high at 2000 Hz with 45% distortion recorded.

Uniformity between channels, Figure 3, was found to be fair with as much as a 7 dB difference being found.

Tone control variability, Figure 4, was good with an adequate change over a broad range being recorded.

NOTE: A series of curves could not be run due to the fact that when an 80 dB input was applied to the system the TDH 39 earphones supplied with the unit would develop a ruptured diaphragm thus rendering the earphone useless as far as further evaluation was concerned. This occured three times. Only one of these units was purchased for this evalution so it could not be determined whether other model 38's would perform in the same manner. At the time that these earphones were damaged,there were three student boxes plugged into the trainer unit with earphones attached. Volume controls were adjusted in accordance with the test procedures.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
TDH 39 M earphone	56	150 - 13000	could not be safely determined.

ECKSTEIN BROTHERS
BINAURAL AUDITORY TRAINER MODEL 38
STUDENT UNIT 38BT

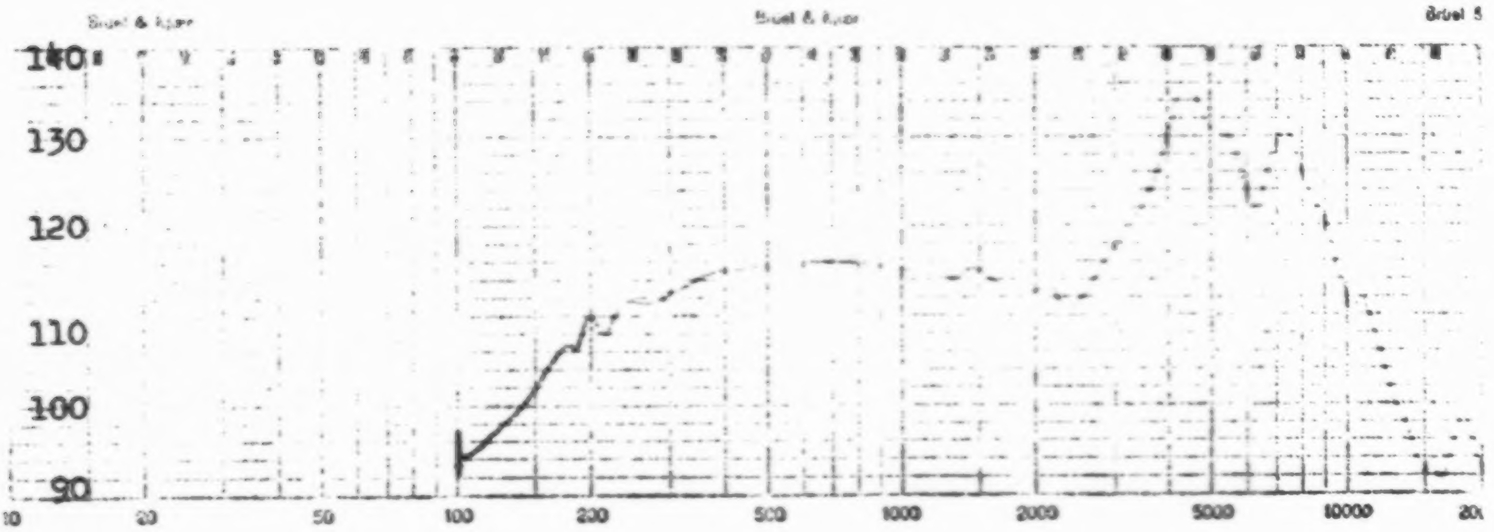


Figure 1 - Gain curve with 60 dB input. Mic. control set at #9 and tone control set at normal. Student unit volume control set at #7.

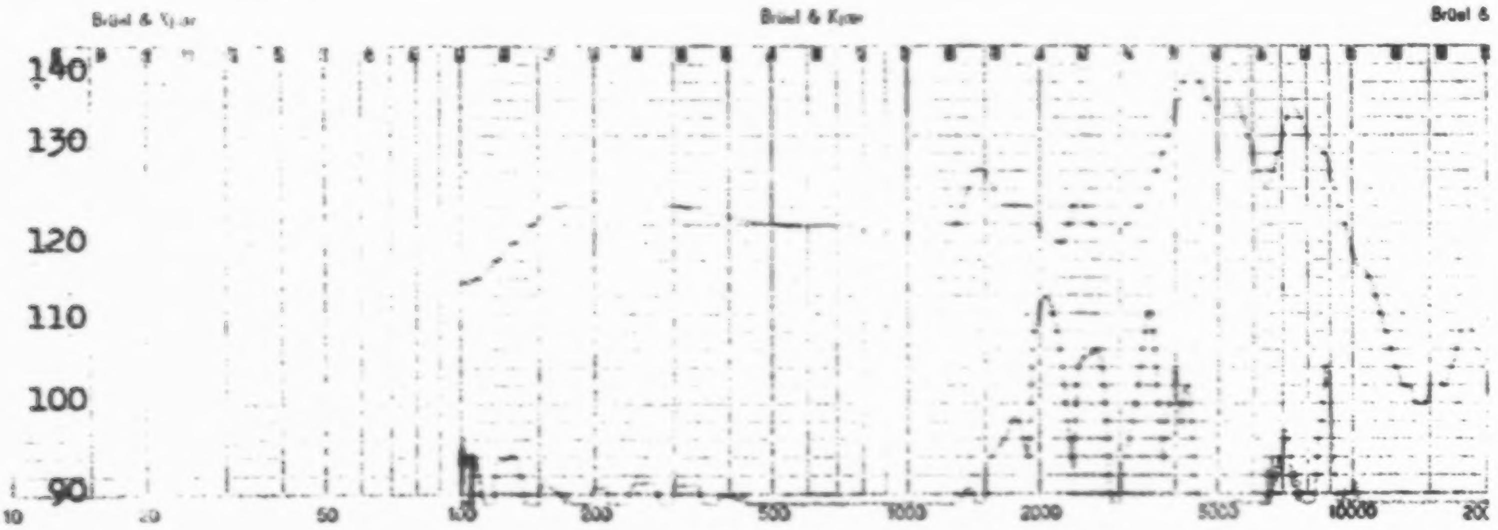


Figure 2 - Second harmonic distortion with an input of 70 dB. Volume control setting at #9. Student unit volume control set at #7. Tone control set at normal.

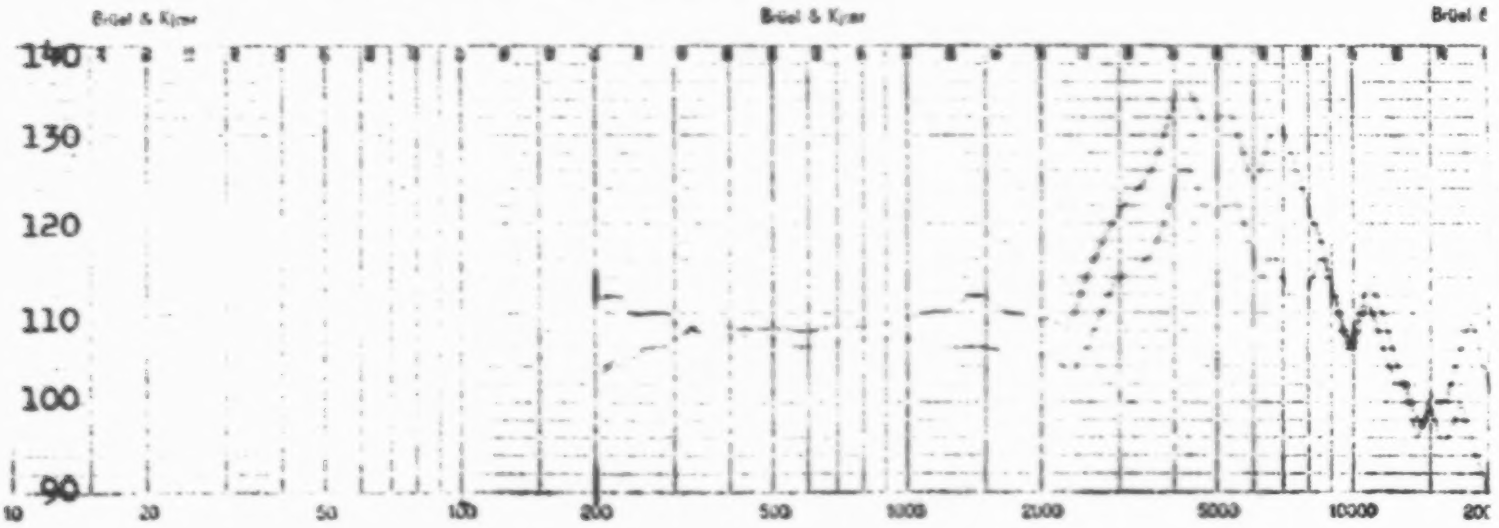


Figure 3 - Uniformity between channels with an input of 60 dB. Volume control set at #9. Student unit volume control set at #7.

ECKSTEIN BROTHERS
BINAURAL AUDITORY TRAINER MODEL 38
STUDENT UNIT 38BT

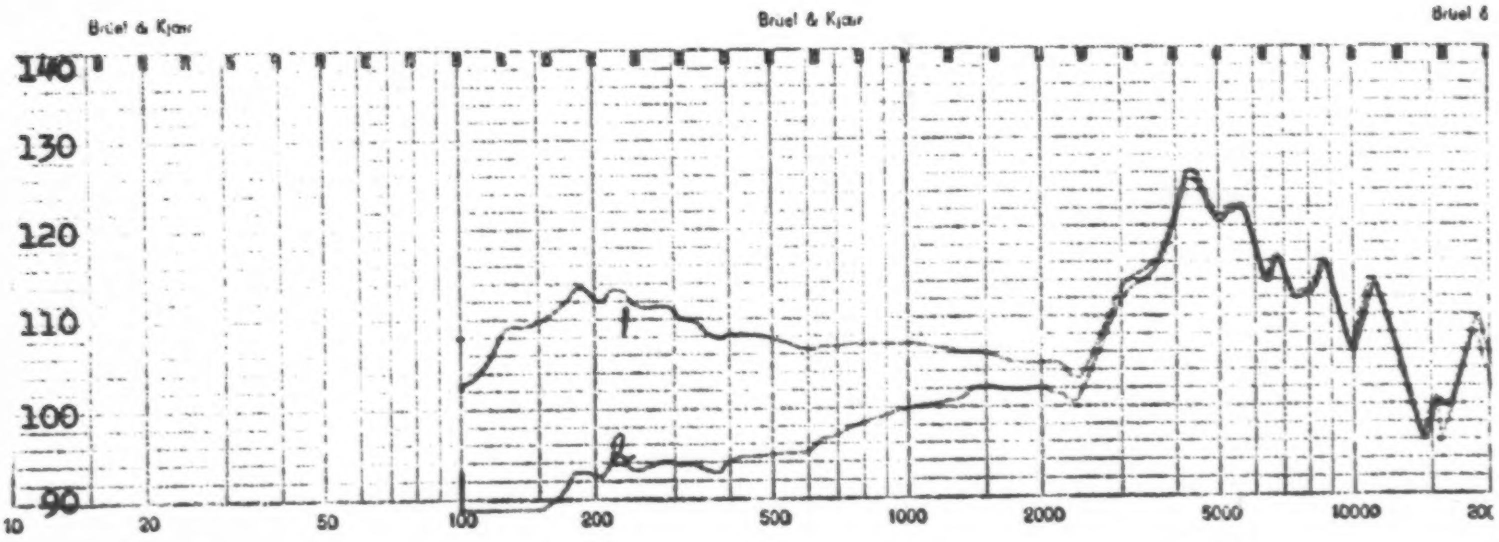


Figure 4 - Effect of tone control settings with an input of 60 dB. Volume control set at #9. Student unit volume control set at #7. Tone control set at normal (curve 1) and at high (curve 2).

QUALITY ASSURANCE

ECKSTEIN 38

This unit was received too late to be evaluated for Quality Assurance.

EDUCATIONAL SURVEY

ECKSTEIN 38

1. Physical Description

   A binaural stereophonic, hard wire, transistor amplifier system with muff type earphones. The headband is vertically adjustable, but inflexible. Muff earphones are light weight and comfortable. The record player and tone arm are of good quality. The fixed auditory trainer with fixed student control boxes having dual controls is operable by the student. The teacher operates major controls. The student is limited in mobility by the length of cords. Desk type mike or lavalier mike are optional. Maintenance must be performed by an electronics technician. The unit is AC power operated and may be used with up to 20 students.

2. Quality

   See Acoustical Response section on this unit.

3. Performance

   See Acoustical Response section on this unit.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

ELECTRONIC FUTURES INCORPORATED

efi
AUDITORY TRAINER
MODULATION
POWER
TAPE
PHONO

CONSOLETTE AND RECEIVER

545 and 145

ELECTRONIC
FUTURES
INCORPORATED

545 and 145

ACOUSTICAL RESPONSE

ELECTRONIC FUTURES INC. 545 & 145

Frequency response uniformity using insert earphones, Figure 1, is fairly uniform up to 1000 Hz after which an 11 dB roll off occurs followed by a 5 dB fluctuation. The rating in this case would be fair.

Frequency response uniformity using TDH 39 M earphones with a full muff was rated as good in that the only major deviation of 8 to 10 dB is found at 2000-3000 Hz. Although the rating in this case is good, at higher input levels the rating would drop to fair.

Frequency response uniformity using the TDH 39 M earphone with the student unit #145 only, Figure 6, with its boom microphone, revealed a curve which falls into the fair category.

Harmonic distortion relative to the trainer control #545 broadcasting to the student receiver #145 was very low for both insert earphone mode and the TDH 39 M earphone mode. When working with the student unit only and using the TDH 39 M earphones, Figure 7, we found a somewhat higher distortion of 14% at one frequency lowering the rating to moderate.

For effect of tone control and tone control calibration, see Figure 8. This instrument uses a continuous type control which should exert at least a 6 dB per octave change from zero to full rotation. The instrument under test exerted a 4 dB per octave change from zero to full rotation. In that this is within 2 dB of our established criteria, the tone variability is rated as fair.

The tone control calibration is somewhat confusing in this respect, in that the dial plate registers from zero to 20 dB but the control exerts a 4 dB per octave change. At 100 Hz, however, 19 dB change is noted which may be the change the dial plate is referring to.

The binaural adjustment control exerted a 20 dB change upon full rotation. The dial plate indicates that a 24 dB change should take place. (see Figure 9).

Gain control calibration for FM and audio reception was excellent as far as the steps were concerned; however, the dial markings may create some confusion in knowing at what level the user is listening.

ACOUSTICAL RESPONSE, CONT.

Uniformity between channels revealed deviations up to 8 dB which earns a fair rating.

Compression action, Figure 5, is the fastest of all the units reported on in this report. Attack time is 30 milliseconds and recovery time is 120 milliseconds. Overshoot and undershoot are minimal, i.e., 5 dB on the attack overshoot and 7 dB on the recovery undershoot. Refer back to our discussion under definitions for more information regarding compression amplification.

By changing the compression control setting from normal to position B, a total drop of approximately 10 dB can be exerted. (see Figures 3, 4, and 5.)

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
consolette and receiver insert earphone	51	100 - 3200	132
consolette and receiver TDH 39 M earphone	45	400 - 6000	122
receiver only TDH 39 M earphone	31	100 - 8500	122

ELECTRONIC FUTURES INC.
AUDITORY TRAINER CONTROL # 545
STUDENT RECEIVER # 145

In compression amplification we have an infinite number of dynamic range capabilities available to us. It is not possible or practical to show all possible combinations. The following charts represent only a few of the combinations for this instrument.

Figure 1 and 2 show the effect of setting compression meter red line for different input levels.

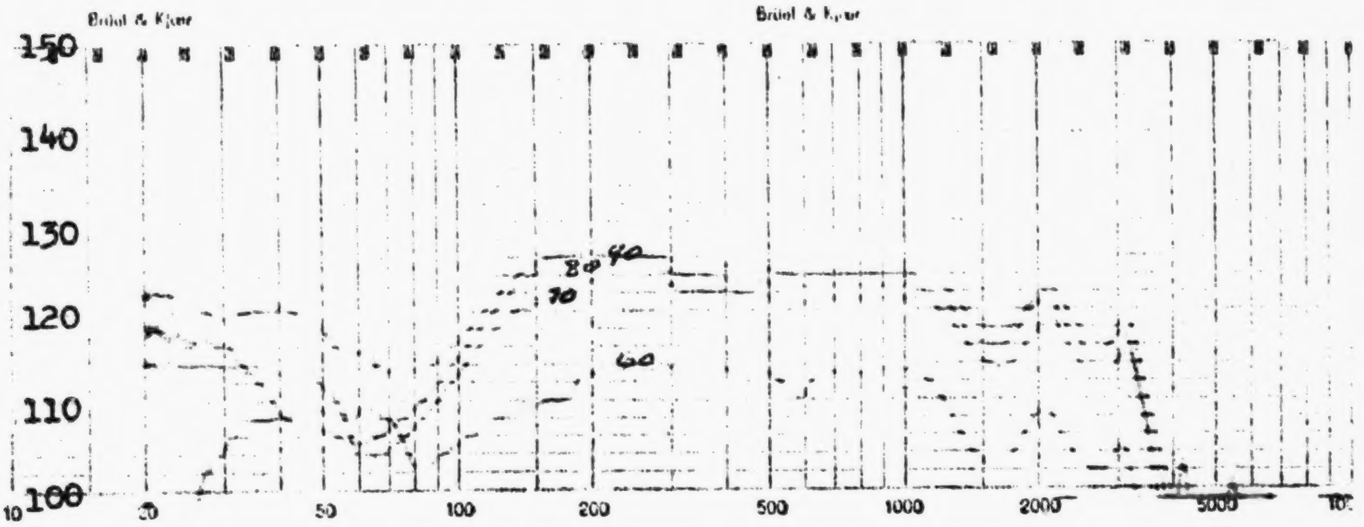


Figure 1 - Series of curves using insert type earphones. Inputs of 60, 70, 80, & 90 dB. Compression position A, compression meter set for red line at 1000 Hz with 70 dB input. Student loop control set for 113 dB output at 1000 Hz with 60 dB input.

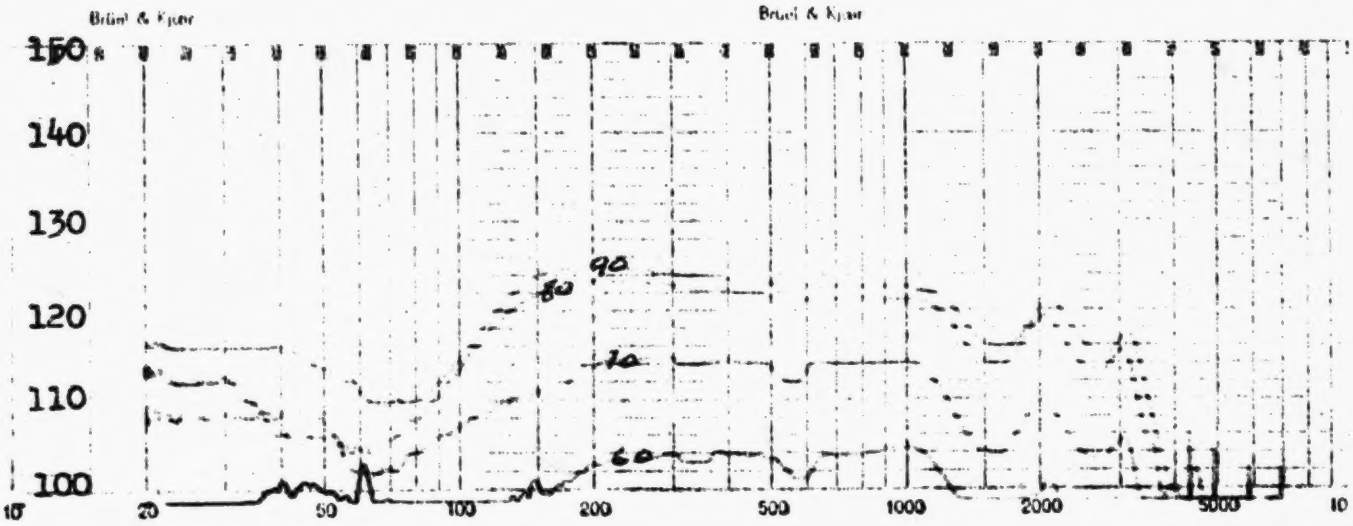


Figure 2 - Series of curves using insert type earphones. Inputs of 60, 70, 80, & 90 dB. Compression position A, compression meter set for red line at 1000 Hz with 80 dB input. Student loop control set for 113 dB output at 1000 Hz with 60 dB input.

ELECTRONIC FUTURES INC.
AUDITORY TRAINER CONTROL # 545
STUDENT RECIEVER # 145

EFFECT OF CHANGING POSITION OF COMPRESSION CONTROL:

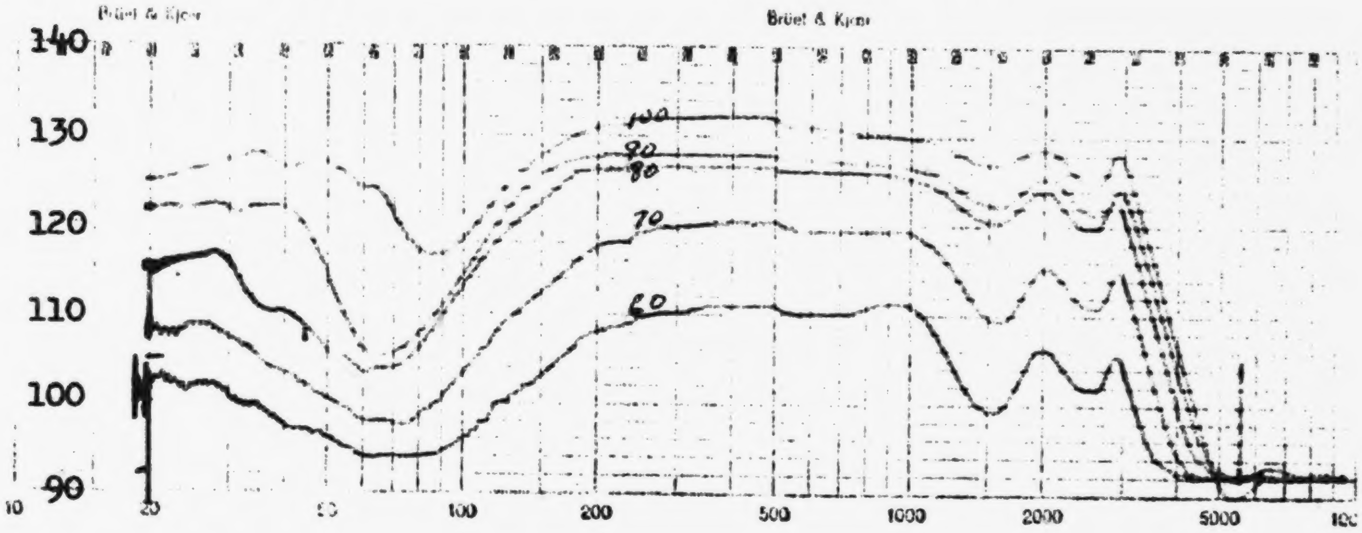


Figure 3 - Series of curves using insert type earphones. Inputs of 60, 70, 80, 90, & 100 dB. Compression position normal. Compression meter set for red line at 1000 Hz with 80 dB input. Student unit set for 130 dB output at 1000 Hz with 100 dB input.

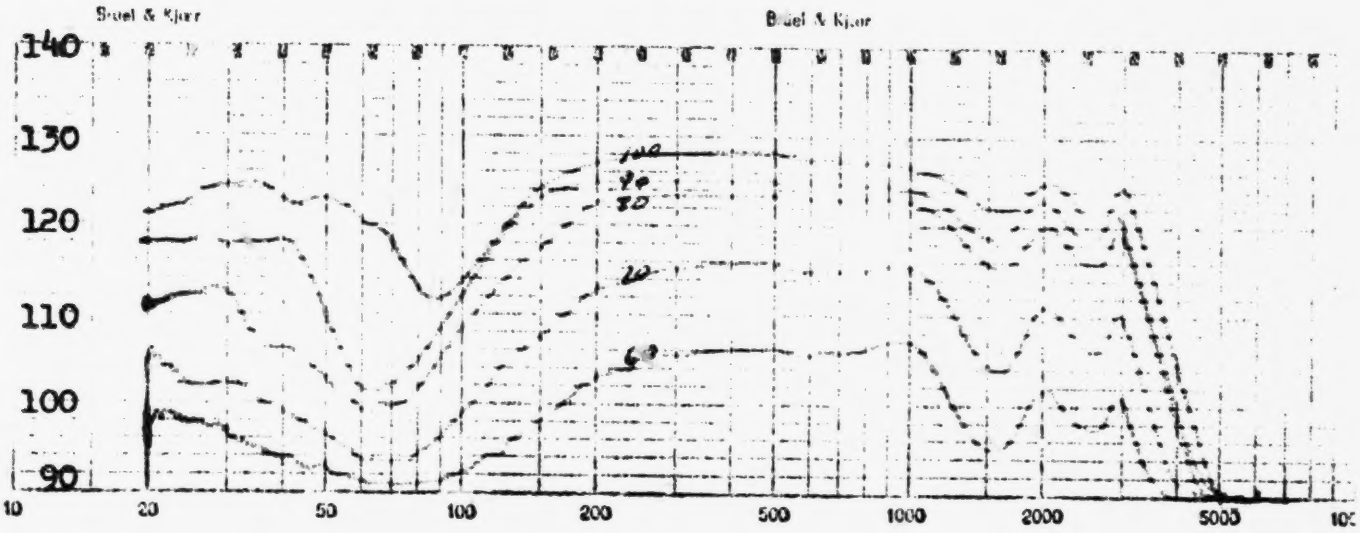


Figure 4 - Series of curves using insert type earphones. Inputs of 60, 70, 80, 90, & 100 dB. Compression position A, Compression meter set for red line at 1000 Hz with 80 dB input. Student unit left at setting established in Figure 3.

ELECTRONIC FUTURES INC.
AUDITORY TRAINER CONTROL # 545
STUDENT RECEIVER # 145

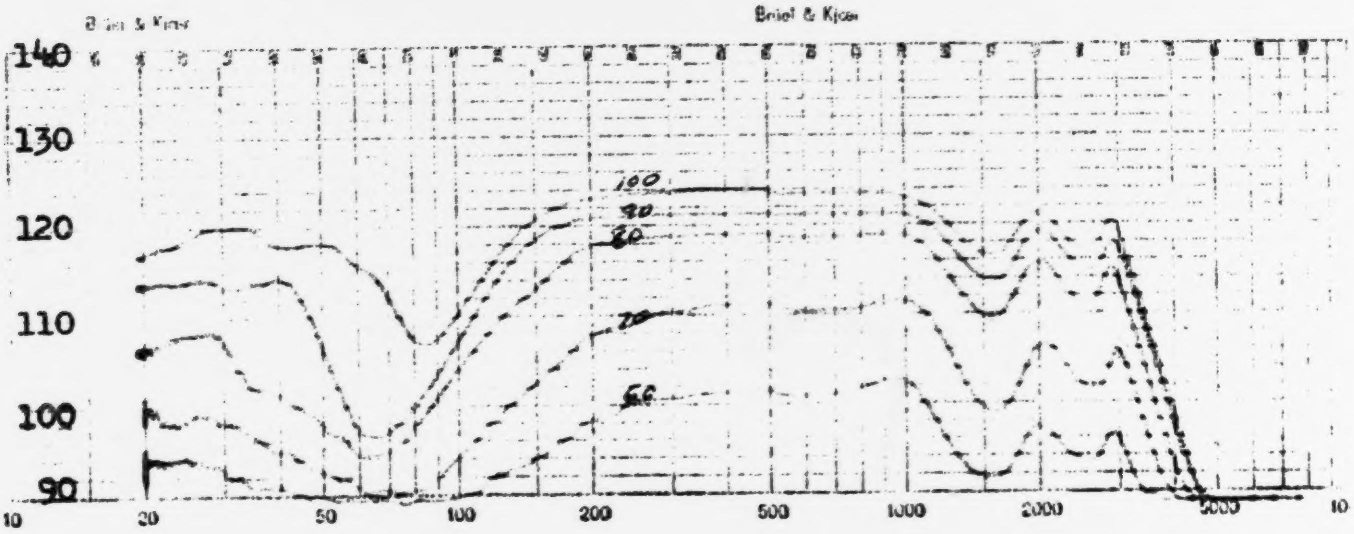


Figure 5A - Series of curves using insert type earphones. Inputs of 60, 70, 80, 90, & 100 dB. Compression position B, compression meter set for red line at 1000 Hz with 80 dB input. Student unit left at setting established in Figure 3.

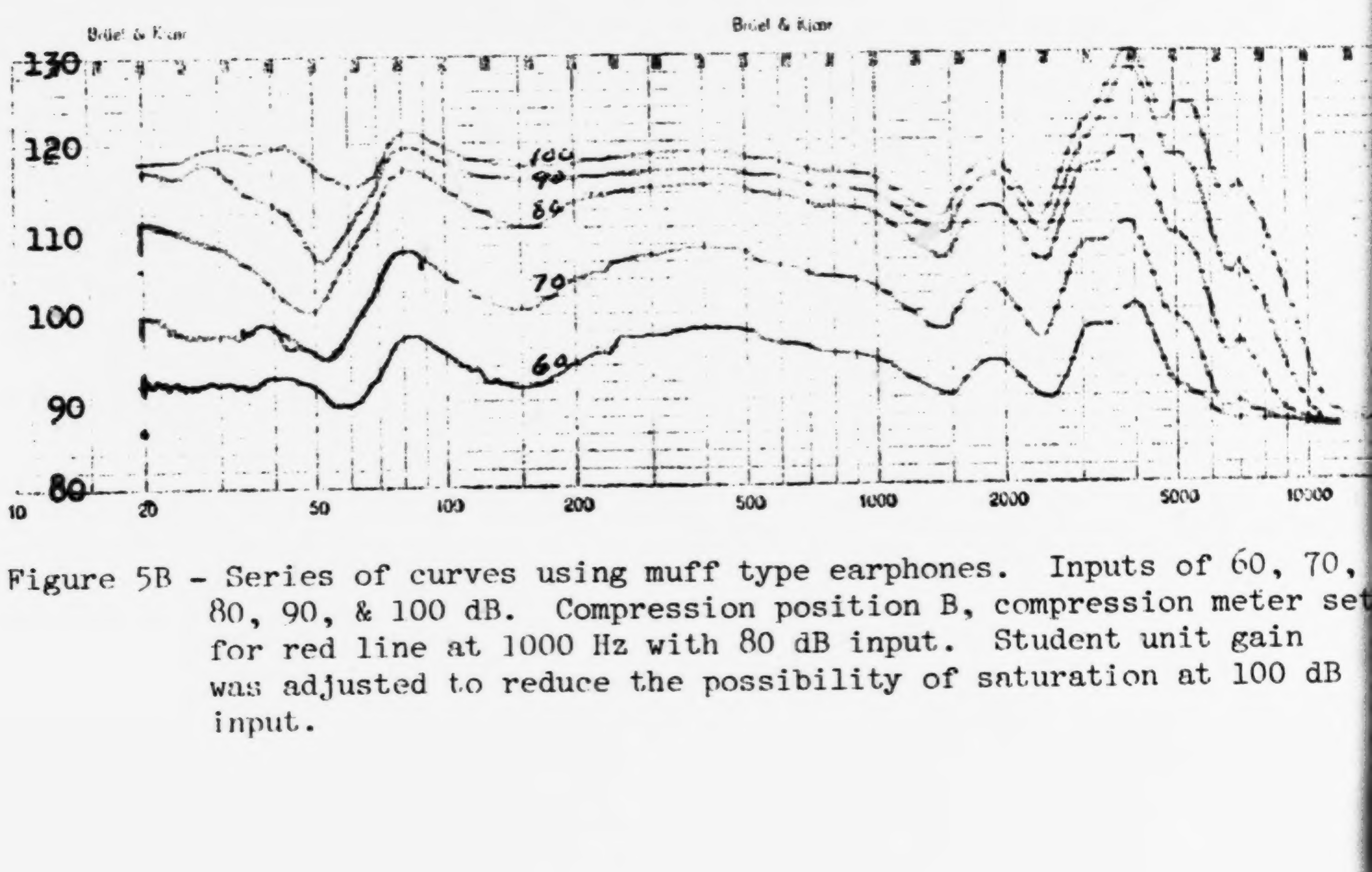


Figure 5B - Series of curves using muff type earphones. Inputs of 60, 70, 80, 90, & 100 dB. Compression position B, compression meter set for red line at 1000 Hz with 80 dB input. Student unit gain was adjusted to reduce the possibility of saturation at 100 dB input.

ELECTRONIC FUTURES INC.
AUDITORY TRAINER CONTROL # 545
STUDENT RECEIVER # 145

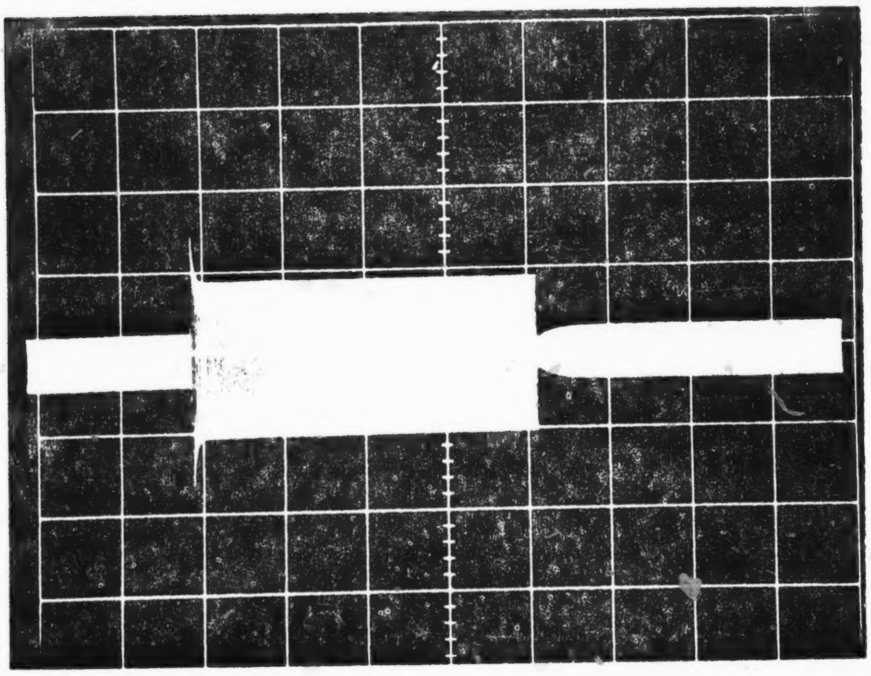


Figure 5C

Attack and release times of compression. All controls we set as described in Figure 5B. The muff type earphone was us Input sequence, 60-80-60 dB. 60 dB input = 94 dB output. 80 dB input = 103 dB output. Attack overshoot 5 dB. Attack undershoot 0 dB. Recovery undershoot 7 dB. Attack time 30 ms. Recovery time 120 ms. Baseline calibration 500 ms/d

Note: The next series of figures represent an evaluation of the student unit only. All curves using the muff type earphone except where noted.

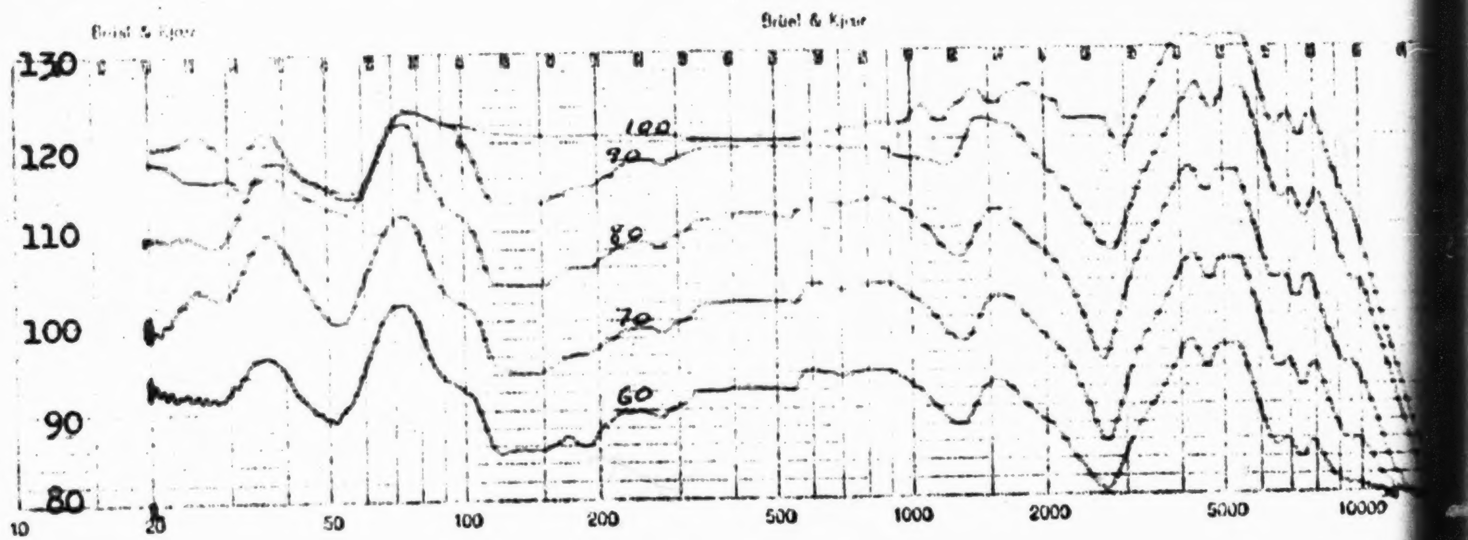


Figure 6 - Series of curves using muff type earphones and student boom mic with inputs of 60, 70, 80, 90, & 100 dB. Mic. control set at maximum. Tone control set at zero.

ELECTRONIC FUTURES INC.

STUDENT RECEIVER # 145

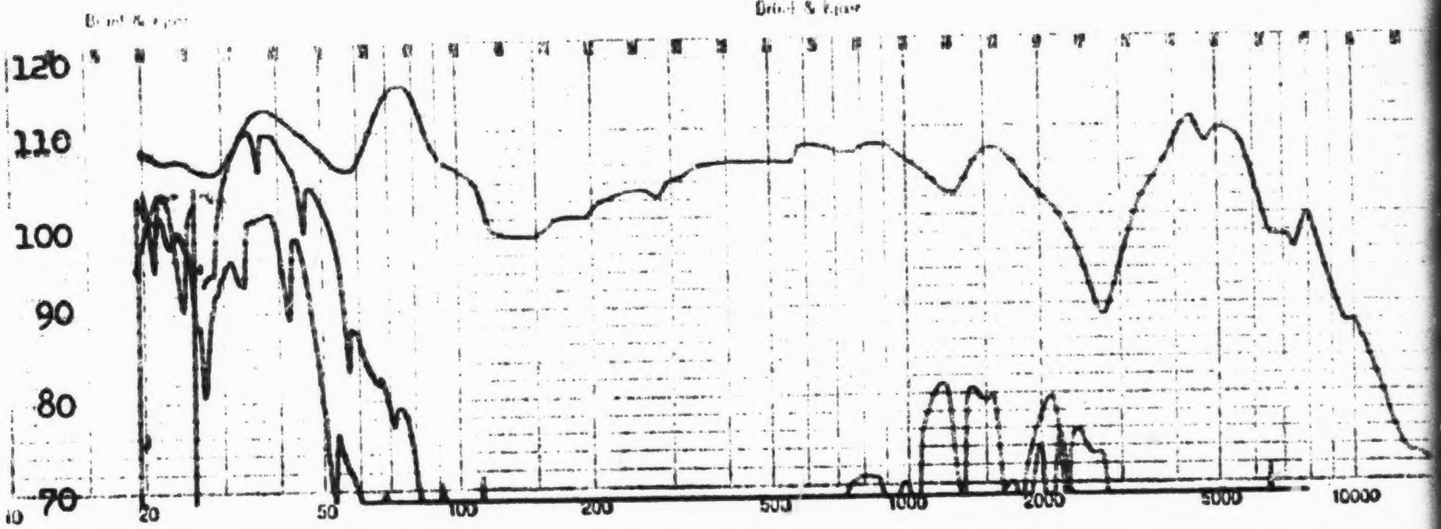


Figure 7 - Second Harmonic distortion with input of 80 dB. Mic. control reduced to 5 dB below maximum. Tone control set at zero.

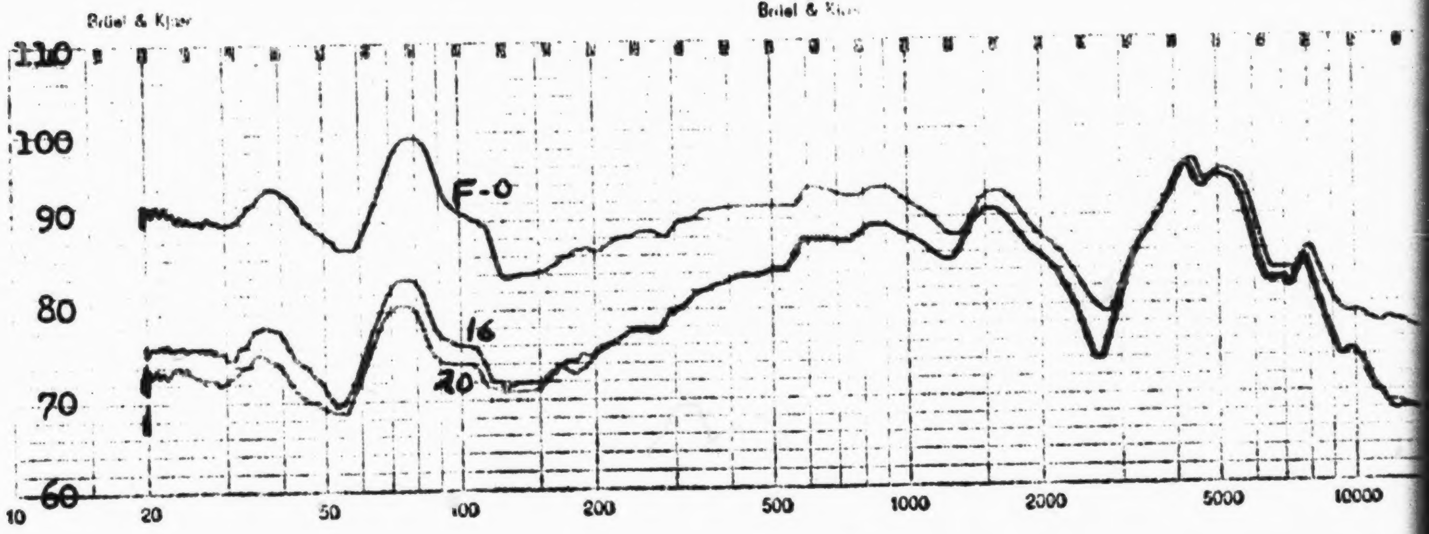


Figure 8 - Effect of tone control changes with an input of 60 dB. Mic. control set at maximum. Tone control adjusted to 0, 16, & 20 d

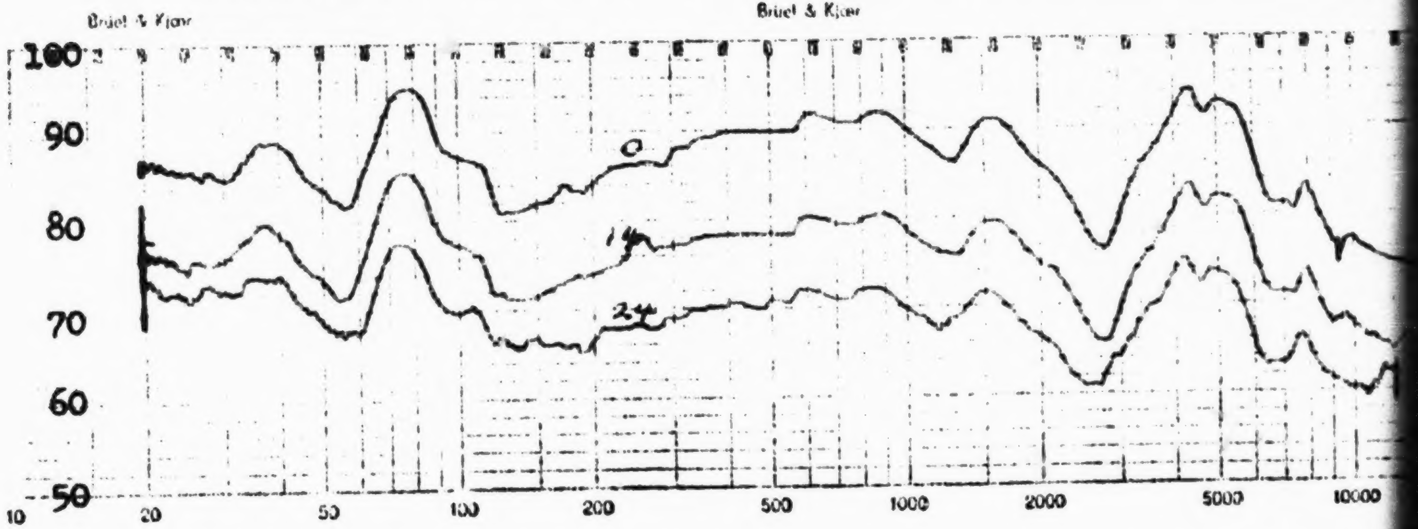


Figure 9 - Effect of changes in the binaural adjustment control, with an input of 60 dB. Mic. control set at maximum. Tone control se at zero. Binaural adjustment set at 0, 14, & 24 dB respectivel

ELECTRONIC FUTURES INC.

STUDENT RECEIVER # 145

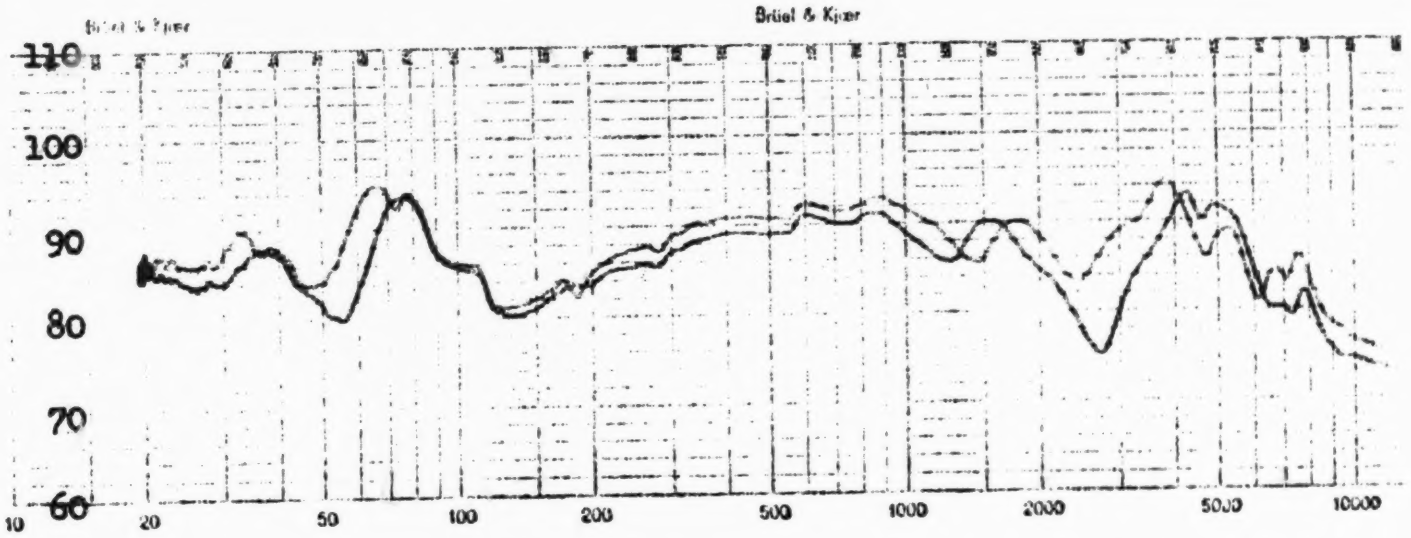


Figure 10 - Uniformity of output between earphones with input of 60 dB. Mic. control set at maximum. Tone control set at zero. Binaural adjustment set at zero.

QUALITY ASSURANCE

ELECTRONIC FUTURES INC.--CONSOLETTE 545

1. Front panel control arrangement is good.

2. General arrangement of parts on chassis is good. Wiring is laid out to provide accessibility to solder points of individual parts. Terminal boards provide optimum arrangement for installing parts and attacking wiring.

3. Parts appear to be high quality commercial type (Sprague, Cornell Dubilier, etc.).

4. Wiring, soldering and general workmanship is above average and should provide for good service and maintainability.

QUALITY ASSURANCE

ELECTRONIC FUTURES INC.--RECEIVER 145

1. Case appears to be of a resinous material, light in weight and flexible. Ability to withstand shock could be a problem. Switch and controls arrangement appears to be good.

2. Battery replacement is accomplished easily but requires unsoldering and resoldering of leads.

3. General arrangement of parts on the circuit board is good and permits relatively good service and maintainability.

4. Parts appear to be standard commercial type.

5. Wiring and soldering and general workmanship are good.

EDUCATIONAL SURVEY

ELECTRONIC FUTURES INC. 545 & 145

1. Physical Description

EFI is a monaural R. F. induction loop system. The master control unit and loop installation are fixed in the classroom. Student units are wearable and permit full mobility. The master control unit is AC powered. The individual student units have rechargeable batteries and provisions must be made for recharging these units. The teacher microphones are lavalier or stand types with connecting cables to the control unit. A Vega wireless mike is available as an optional feature. Student microphones are fastened to each headset by an adjustable boom.
Headsets are comfortable and easily adjustable. A student clip-on mike is available when using the insert receiver.
The main unit is controlled by the teacher. Students have access to the controls on their own units.
Repair requires the services of an electronics technician.

2. Quality

The workmanship is excellent and high quality parts are used. The case is durable.

3. Performance

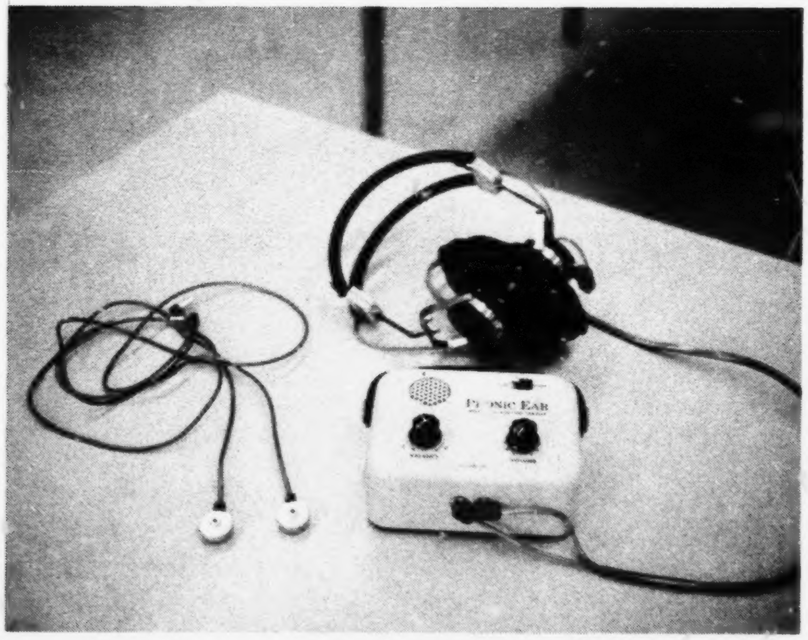
Arrangement for the tone control is unsatisfactory and not readily accessible. The individual earphone adjustment controls are good. The compression circuit is excellent.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

This unit can be used in regular classes as a conventional hearing aid unit only.

H. C. ELECTRONICS



AUDITORY TRAINER

217

H. ELECTRONICS

ACOUSTICAL RESPONSE

H. C. ELECTRONICS 217

Uniformity of frequency response, Figure 1, shows the sudden rise in the curve beginning at 1500 Hz and ending at 3000 Hz representing a 20 dB change. This is rated as poor by our established criteria.

The TDH 39 earphone with a muff attachment also exhibits a poor uniformity of response. (see Figure 5, curve 2).

Harmonic distortion was low, exhibiting only 5.6% at 2700 Hz. (see Figure 2).

Effect of tone control was found to be only fair.

Uniformity between channels was good as the difference between curves did not vary more than 4 dB.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
insert earphone	63	400 - 4500	140

H. C. ELECTRONICS, INC.
PHONIC EAR MONAURAL AUDITORY TRAINER
MODEL 217

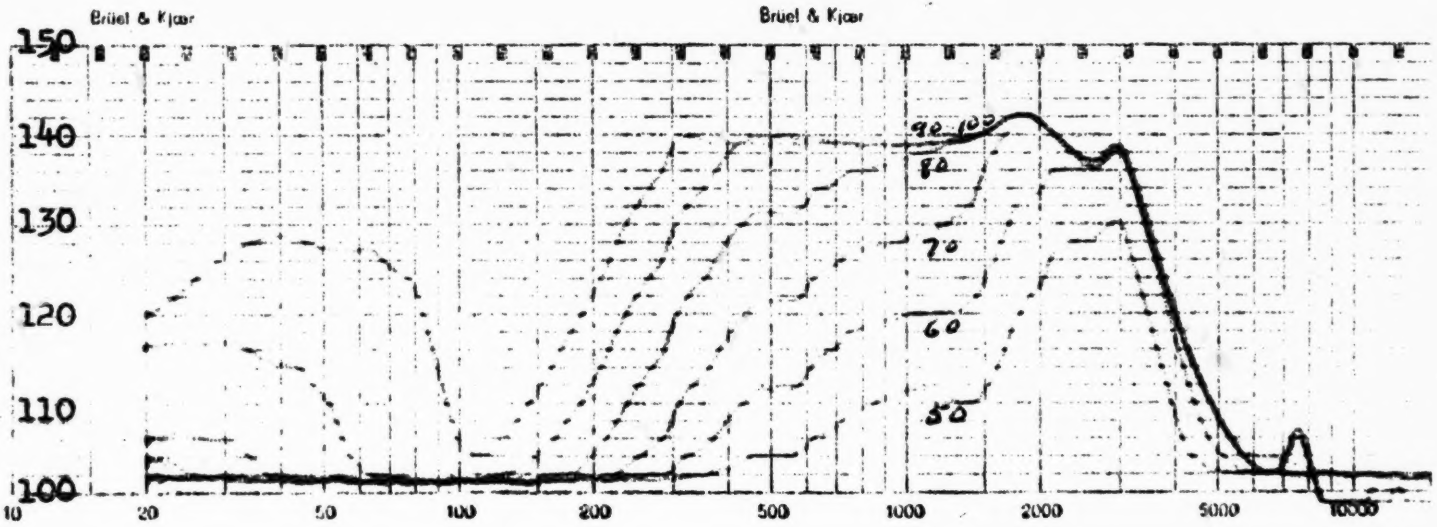


Figure 1 - Series of curves using insert type earphone. Inputs of 50, 60, 70, 80, 90, & 100. Volume control set at maximum. Balance control set at midpoint. Tone control set at low.

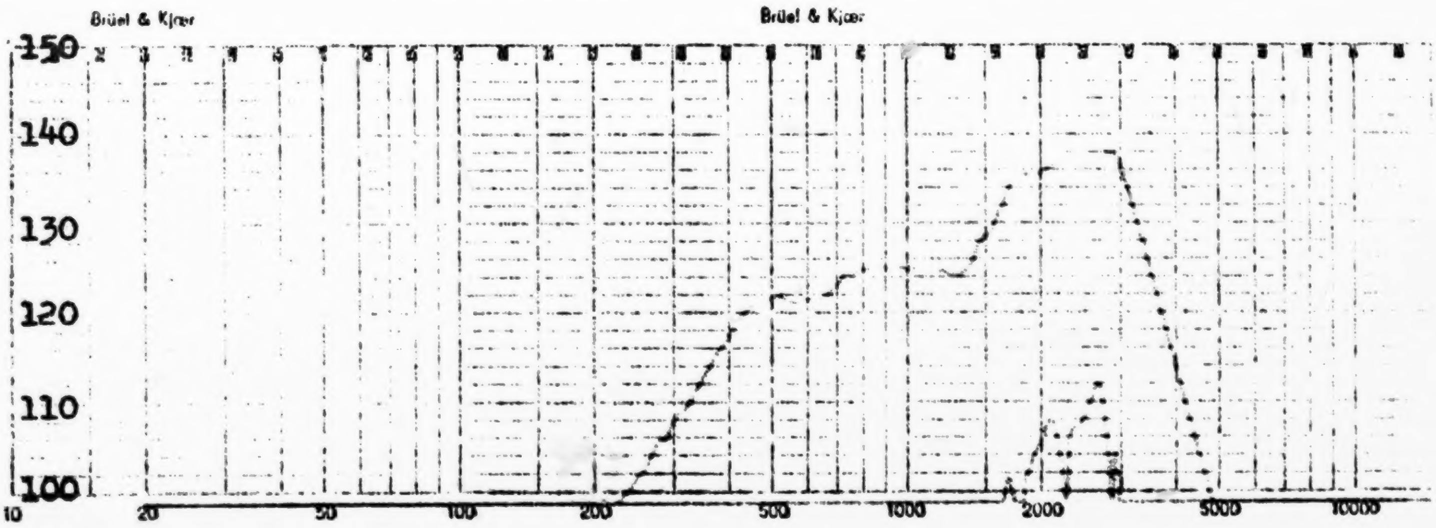


Figure 2 - Second Harmonic distortion with insert type earphones. Input of 70 dB. Volume control set 5 dB below maximum. Balance control set at midpoint. Tone control set at low.

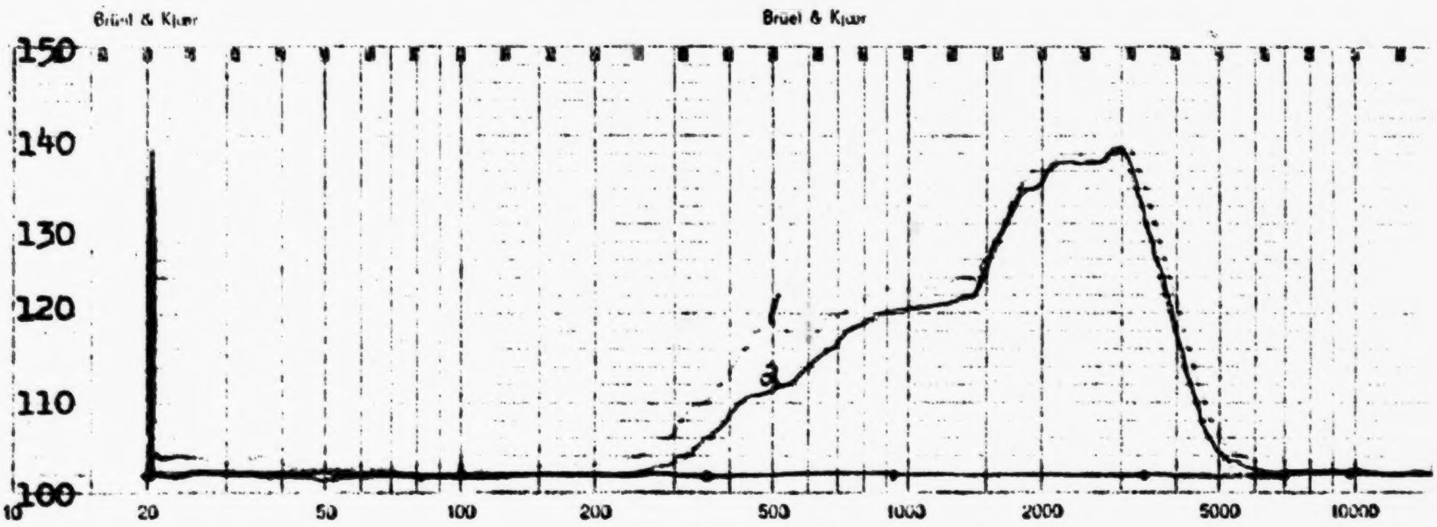


Figure 3 - Effect of tone control using insert type earphones. Input of 60 dB. Volume control set at maximum. Balance control set at mi
point. Curve 1 - low tone emphasis, Curve 2 - high tone emphasis.

H. C. ELECTRONICS, INC.
PHONIC EAR MONAURAL AUDITORY TRAINER
MODEL 217

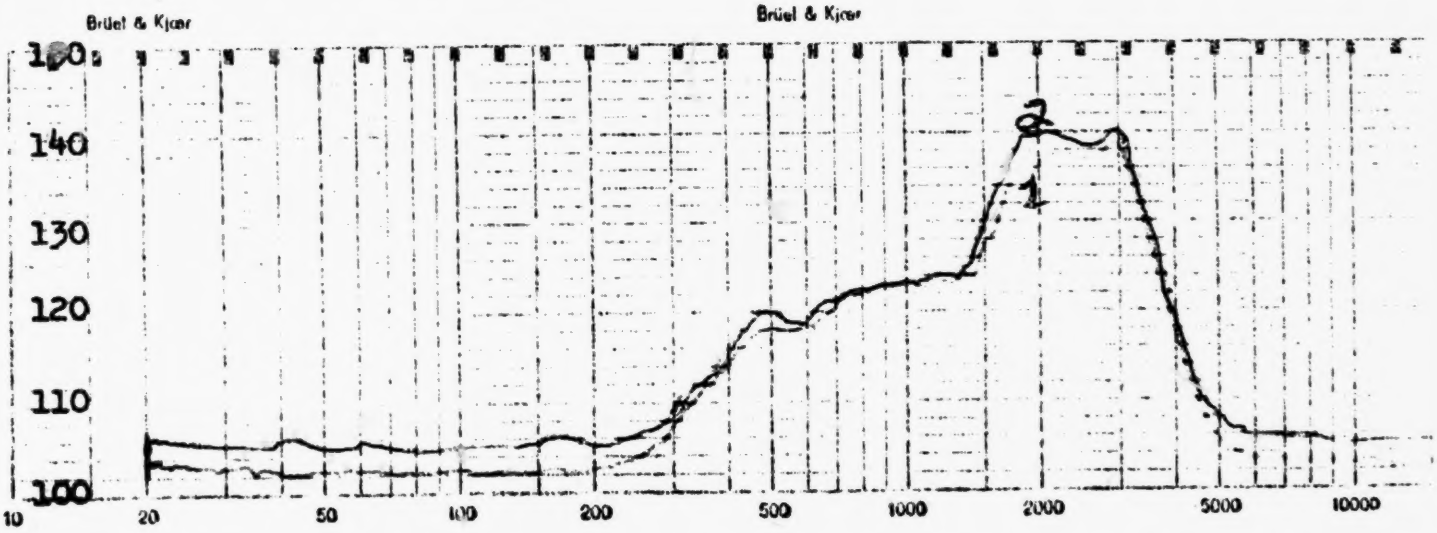


Figure 4 - Uniformity of channel output with insert type earphones. Input of 60 dB. Volume control set at maximum. Balance set at midpoint. Tone control set at low. Curve 1 - right channel, Curve 2 - left channel.

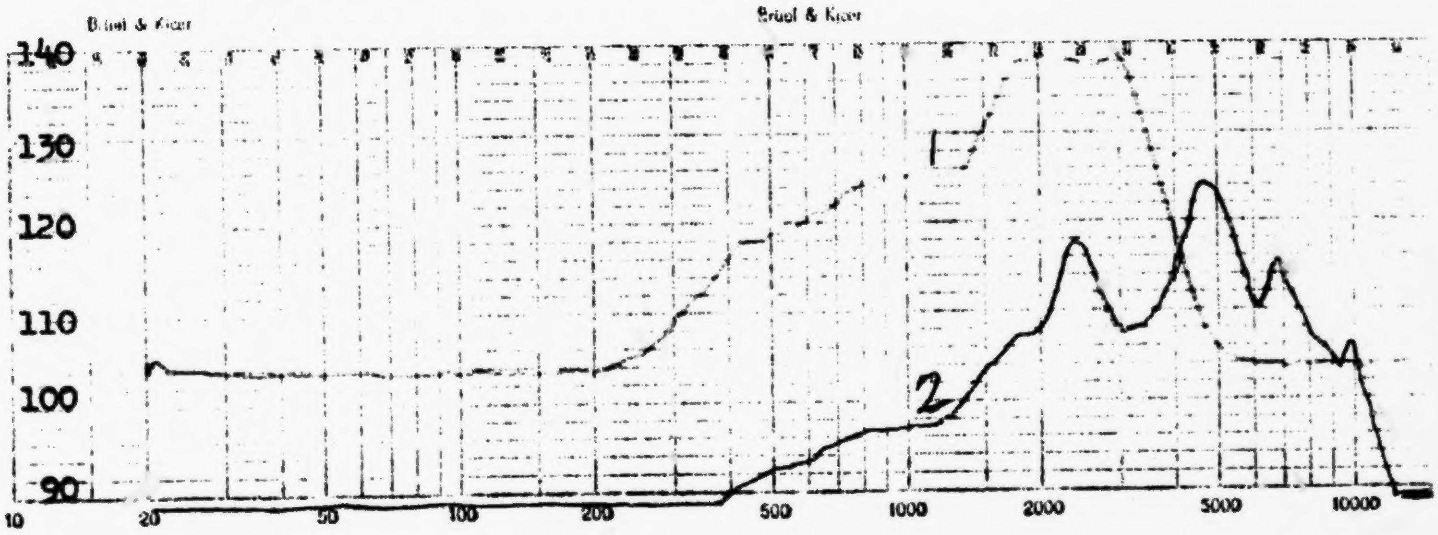


Figure 5 - Comparison of insert type earphone (curve 1) and TDH-39 muff type earphone (curve 2). Input of 60 dB. Volume control set at maximum. Balance control set at midpoint. Tone control set at low.

QUALITY ASSURANCE

H. C. ELECTRONICS 217

1. Enamelled metal case. Good serviceability.
2. Controls are well arranged and adequately marked.
3. Battery replaceability is easily accomplished but requires unsoldering of wire leads.
4. General arrangement of parts is good. However, mounting of two auditory units to case by soldering precludes the easy removal of the circuit board.
5. Soldering, wiring and general workmanship are good.
6. Parts are standard commercial type.
7. Service and maintainability aspects are good.

EDUCATIONAL SURVEY

H. C. ELECTRONICS 217

1. Physical Description

This is a self contained, portable monaural amplification unit which may be utilized on a desk, hand-carried or worn on the body. It uses either AC or DC power and the batteries are rechargeable. It has a built-in microphone. The headset is somewhat uncomfortable. The unit is student controlled.

2. Quality

The quality is rated consistently good. When the rechargeable battery needs replacement, such replacement should be made by an electronics technician.

3. Performance

Although the frequency response meets the rating for fair, this response except in some high frequency hearing losses, is not considered ideal. It is considered a high gain instrument.

4. Educational Suitability

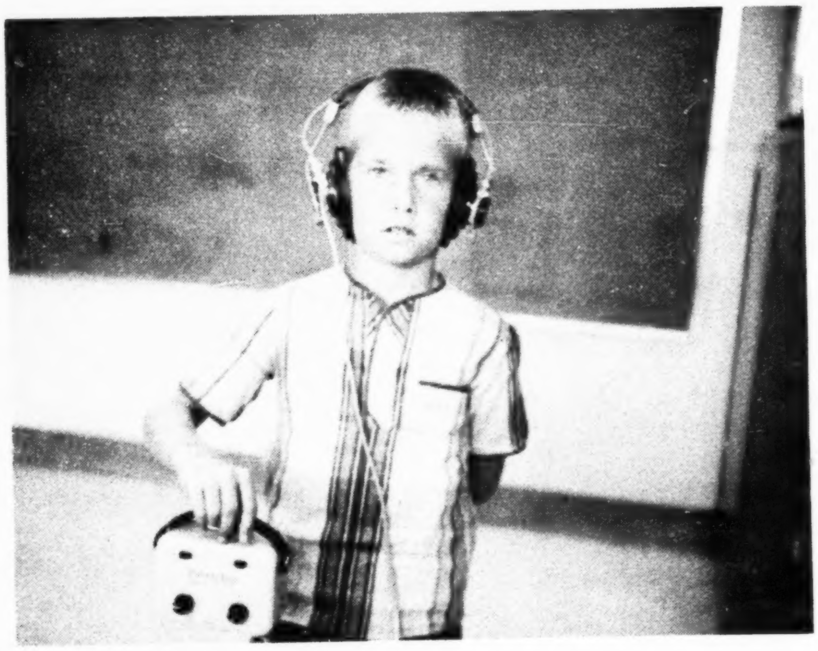
	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

H. C. ELECTRONICS

AUDITORY TRAINER

218

H. C. ELECTRONICS



ACOUSTICAL RESPONSE

H. C. ELECTRONICS 218

Uniformity of frequency response, Figure 1 and Figure 3, is good as there is only one deviation of up to 10 dB. Response with the TDH 39 earphone with the muff attachment revealed a jaggedness which would rate the unit as poor.

Harmonic distortion at its highest point was 6.3% providing us with a low harmonic distortion rating. (see Figure 2).

Tone control variability is small and rates fair. (see Figure 5).

Uniformity between channels, Figure 6, does not exceed 4 dB and rates good.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
insert earphone	65	180 - 3600	141

H. C. ELECTRONICS, INC.
PHONIC EAR MONAURAL AUDITORY TRAINER
MODEL 218

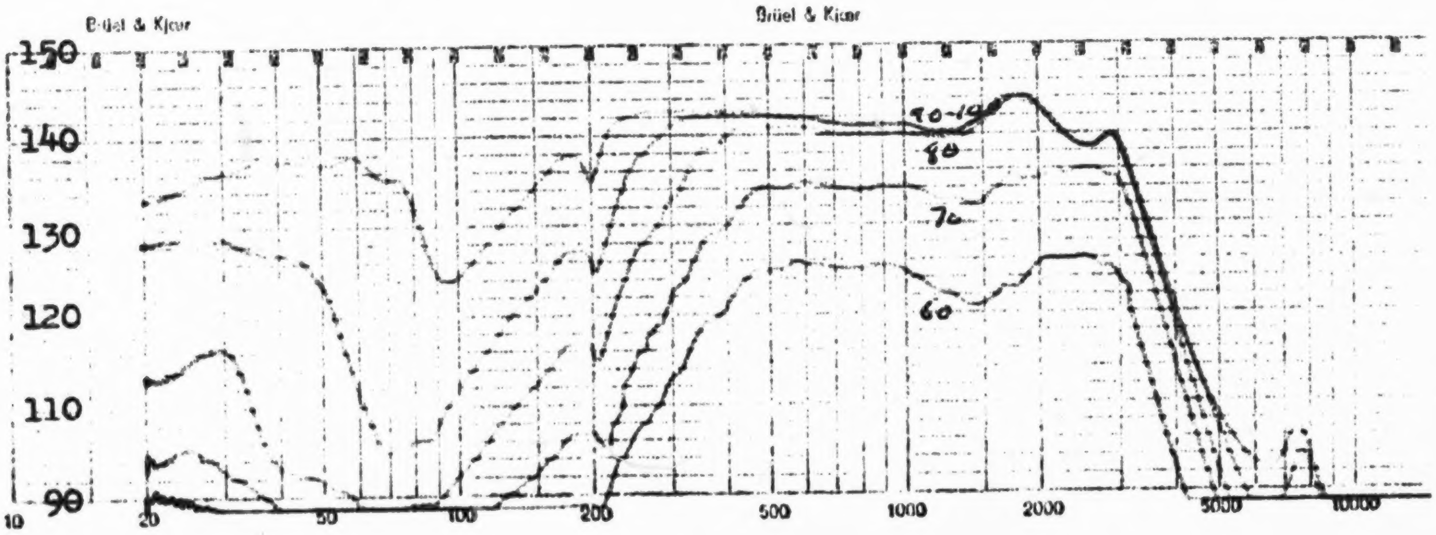


Figure 1 - Series of curves with insert type earphone. Input of 60, 70, 80, 90, & 100 dB. Right volume control set at maximum. Tone control set at low.

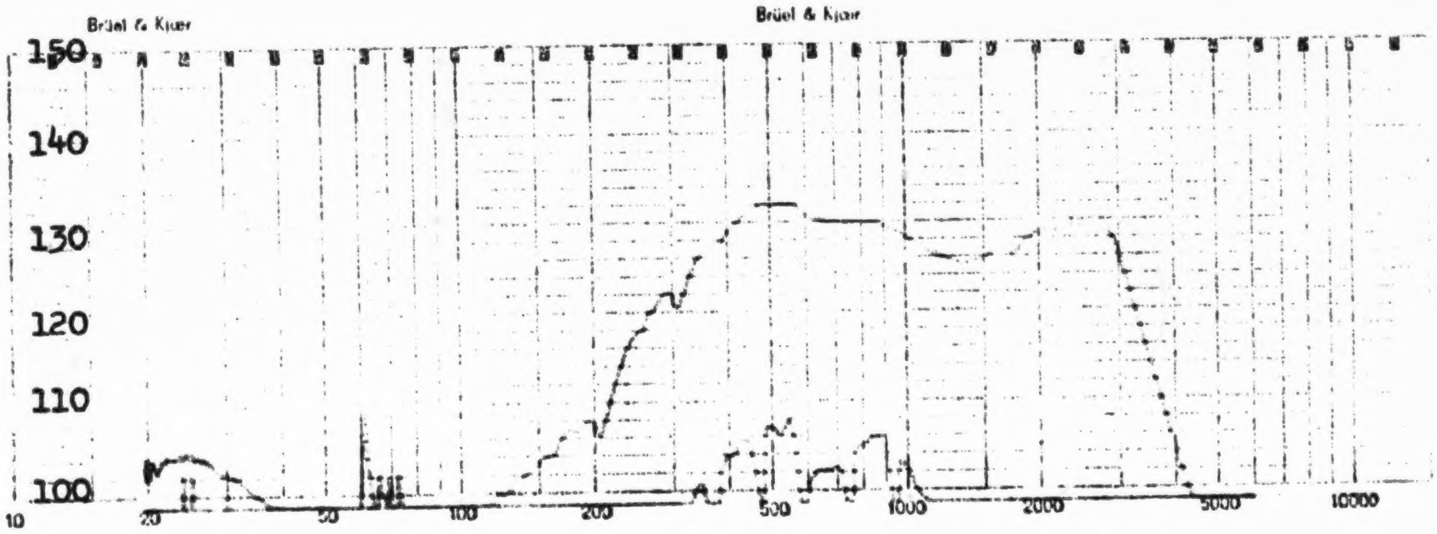


Figure 2 - Second Harmonic distortion with insert type earphone. Input of 70 dB. Right volume 5 dB below maximum. Tone control set at low.

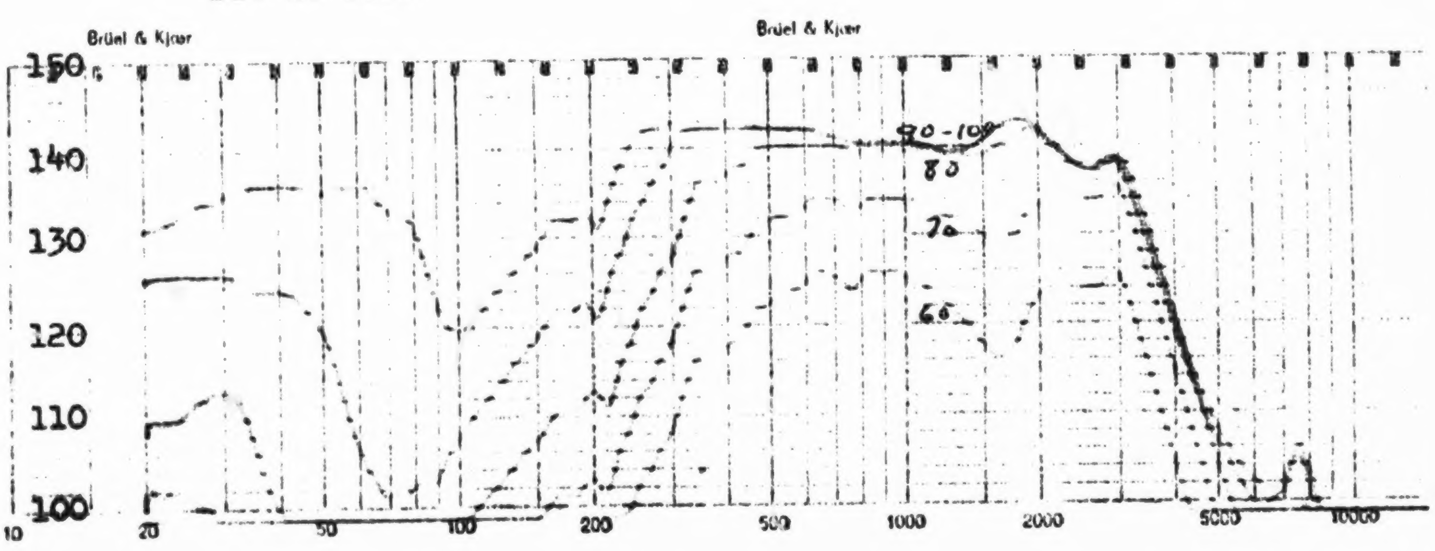


Figure 3 - Series of curves with insert type earphone. Input of 60, 70, 80, 90, & 100 dB. Left volume control set at maximum. Tone control set at low.

H. C. ELECTRONICS, INC.
PHONIC EAR MONAURAL AUDITORY TRAINER
MODEL 218

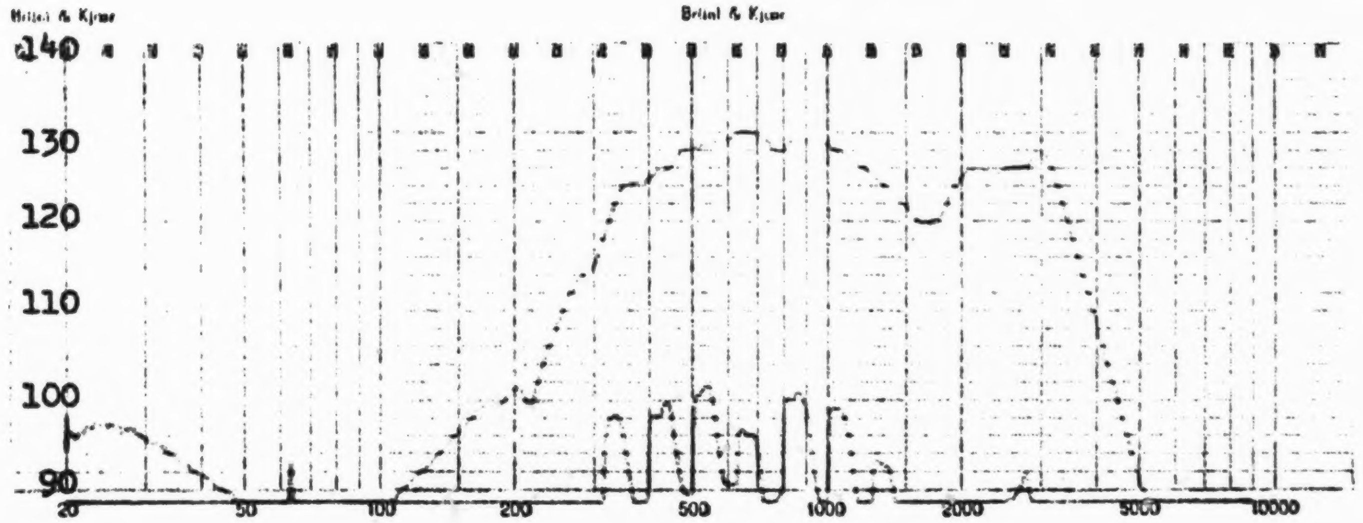


Figure 4 - Second Harmonic distortion with insert type earphone. Input of 70 dB. Left volume control set at 5 dB below maximum. Tone control set at low.

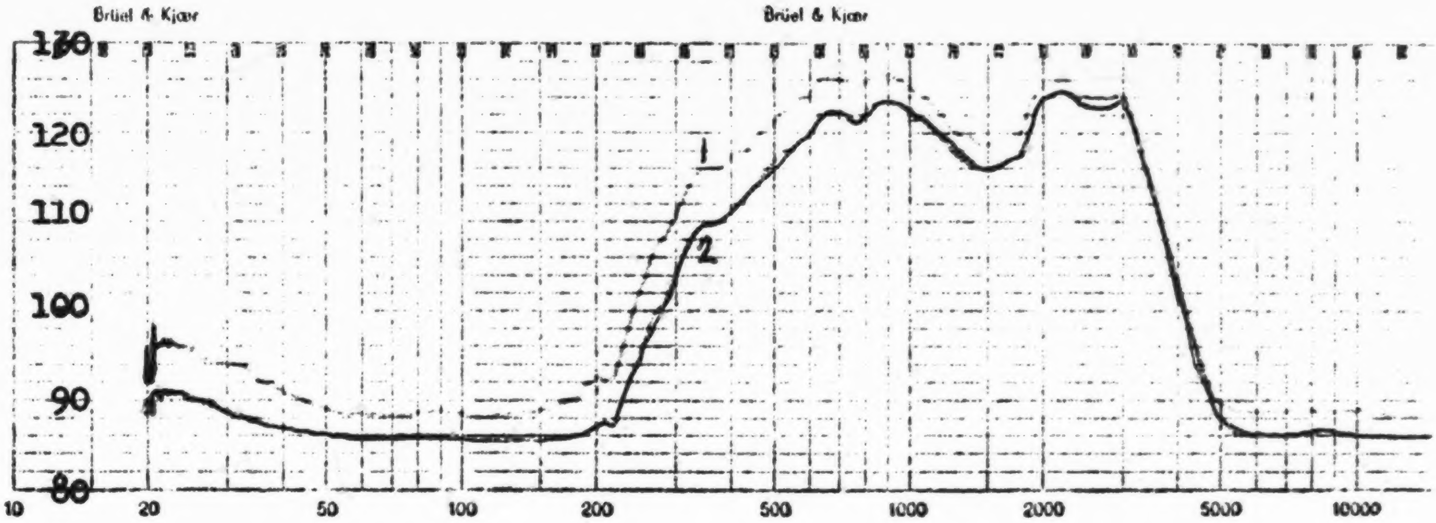


Figure 5 - Effect of tone control with insert type earphone. Input of 60 dB. Right volume set at maximum. Curve 1 - low tone emphasis. Curve 2 - high tone emphasis.

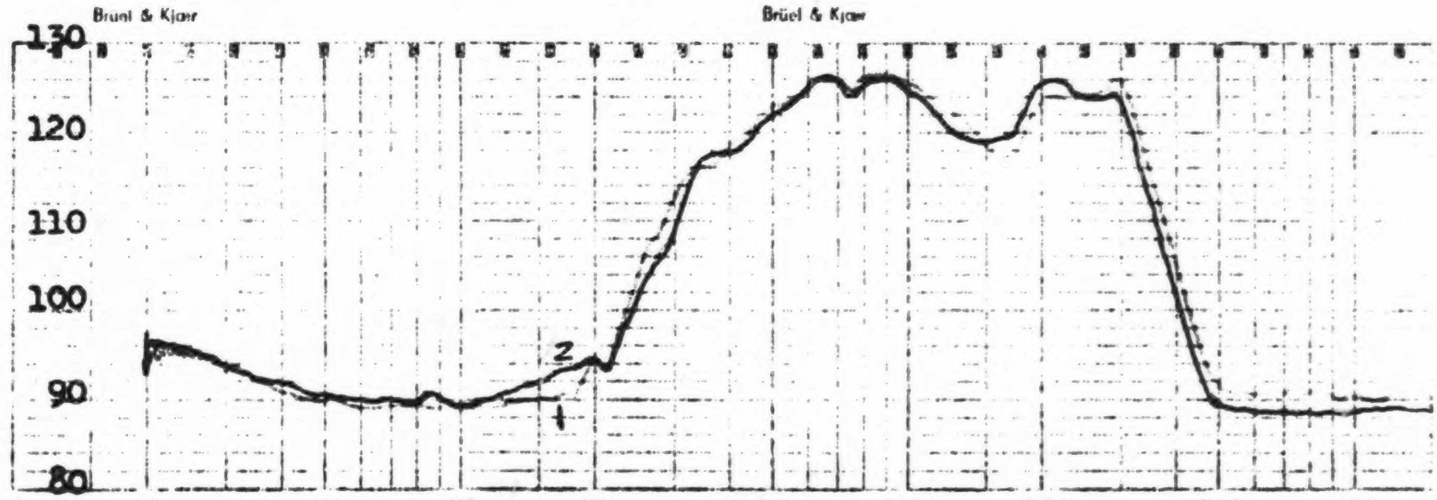


Figure 6 - Uniformity of channels, with insert type earphones. Input of 60 dB. Curve 1 - right volume control set at maximum and tone control on low. Curve 2 - left volume control set at maximum and tone control on low.

H. C. ELECTRONICS, INC.
PHONIC EAR MONAURAL AUDITORY TRAINER
MODEL 218

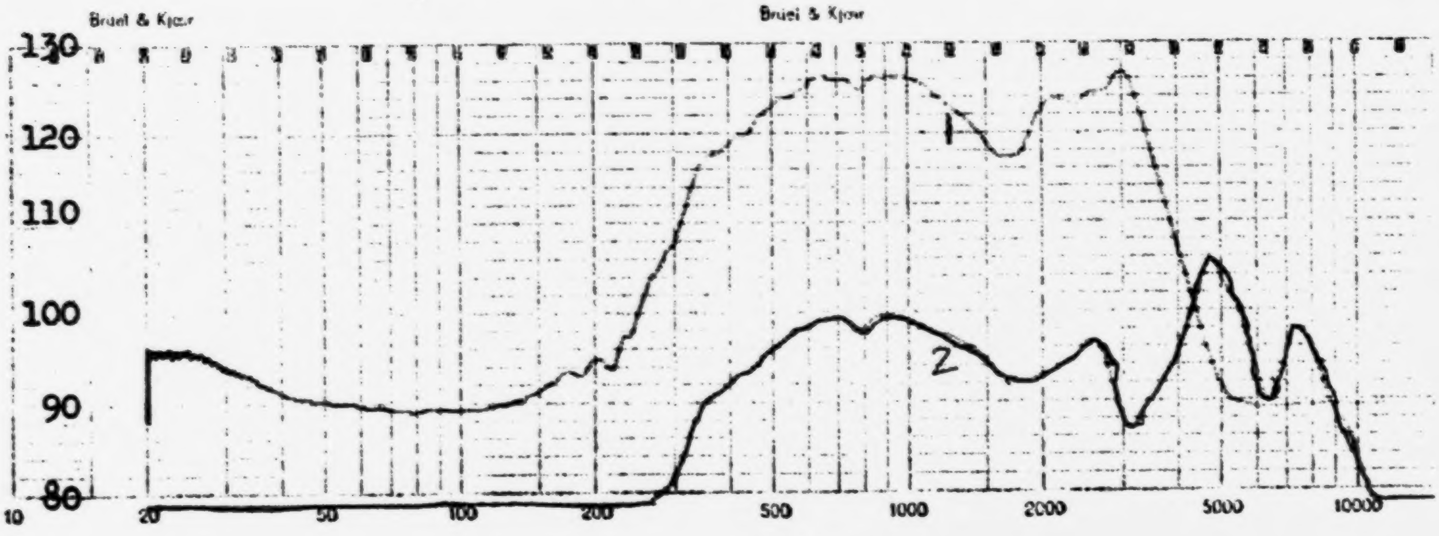


Figure 7 - Comparison of insert type earphones (1) and TDH-39 muffs (2). Input of 60 dB. Right volume control set at maximum. Right tone control set at low.

QUALITY ASSURANCE

H. C. ELECTRONICS 218

1. Enamelled metal case. Good serviceability.
2. Controls well arranged and adequately marked.
3. Battery replaceability is easily accomplished but requires unsoldering of wire leads.
4. General arrangement of parts is good. However, mounting of two auditory units to case by soldering precludes the easy removal of the circuit board.
5. Soldering, wiring and general workmanship are good.
6. Parts are standard commercial type.
7. Service and maintainability aspects are seriously compromised by the method of attaching (soldering) units to side of case.

EDUCATIONAL SURVEY

H. C. ELECTRONICS 218

1. Physical Description

This is a self contained, portable monaural amplification unit which may be utilized on a desk, hand-carried, or worn on the body. It uses either AC or DC power and the batteries are rechargeable. It has a built-in microphone. The headset is somewhat uncomfortable. The unit is student controlled.

2. Quality

The quality is rated consistently good. When the rechargeable battery needs replacement, such replacement should be made by an electronics technician.

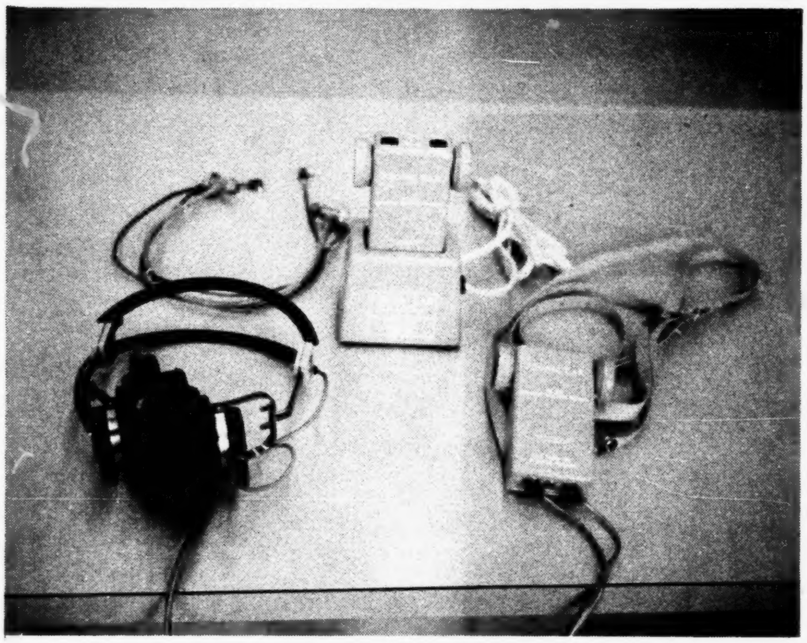
3. Performance

The frequency response uniformity and range are good. It is a high gain instrument with low distortion.

4. Educational Suitability

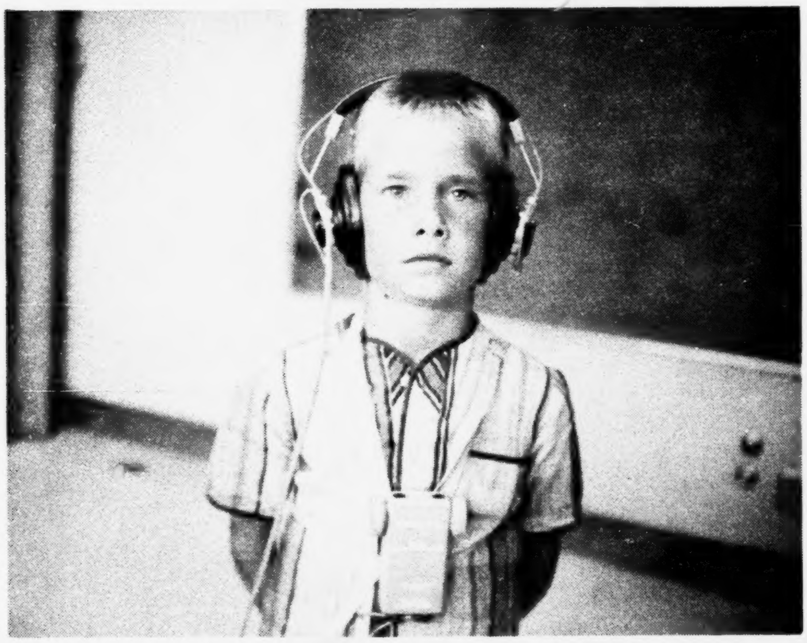
	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

H. C. ELECTRONICS



AUDITORY TRAINER

H. C. ELECTRONICS



ACOUSTICAL RESPONSE

H. C. ELECTRONICS HC 219

Frequency response uniformity, Figures 1, 3, and 6, rates only fair by our response criteria in view of the 10 to 12 dB valley in the area of 1000 Hz and the sharp rise thereafter. When using the TDH 39 earphone with the muff attachment, the rating drops to poor because of the marked jaggedness of the curve.

Harmonic distortion, Figure 2, reaches a maximum of only 7% at 500 Hz which is low.

Uniformity between channels is good as the difference does not exceed 4 dB. See Figure 5.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
insert earphones	67	310 - 3800	142
TDH 39 earphones	38	300 - 10000	

H. C. ELECTRONICS, INC.
PHONIC EAR BINAURAL AUDITORY TRAINER
MODEL 219

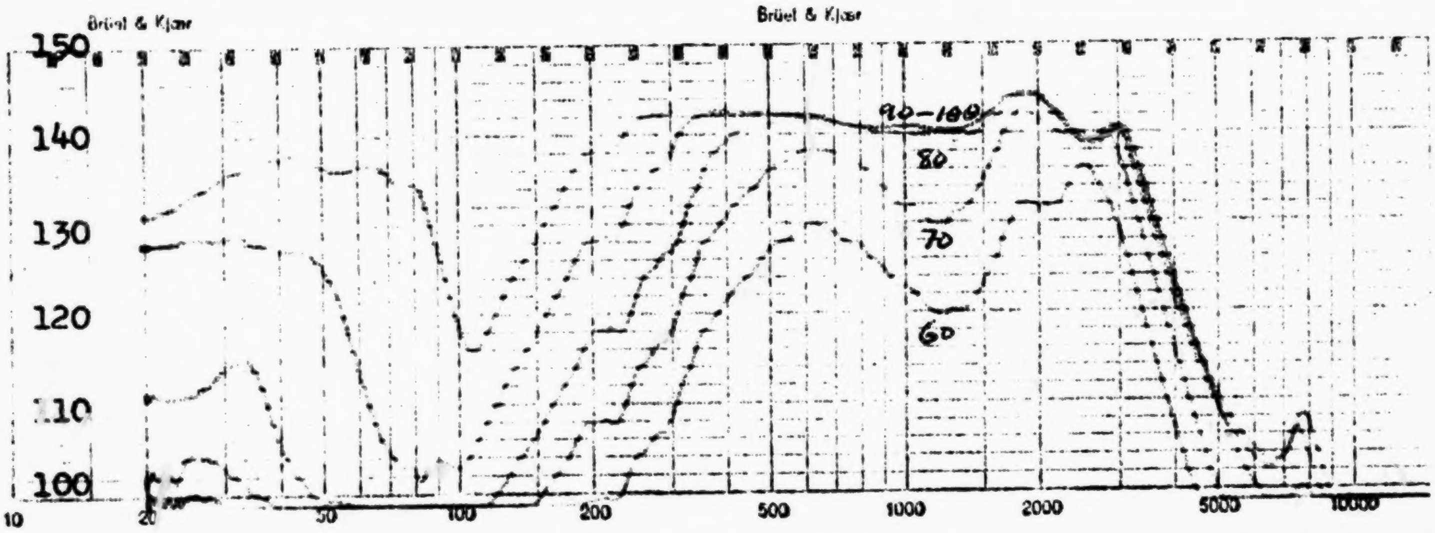


Figure 1 - Series of curves with insert type earphone. Inputs of 60, 70, 80, 90, & 100 dB. Right gain control set at maximum.

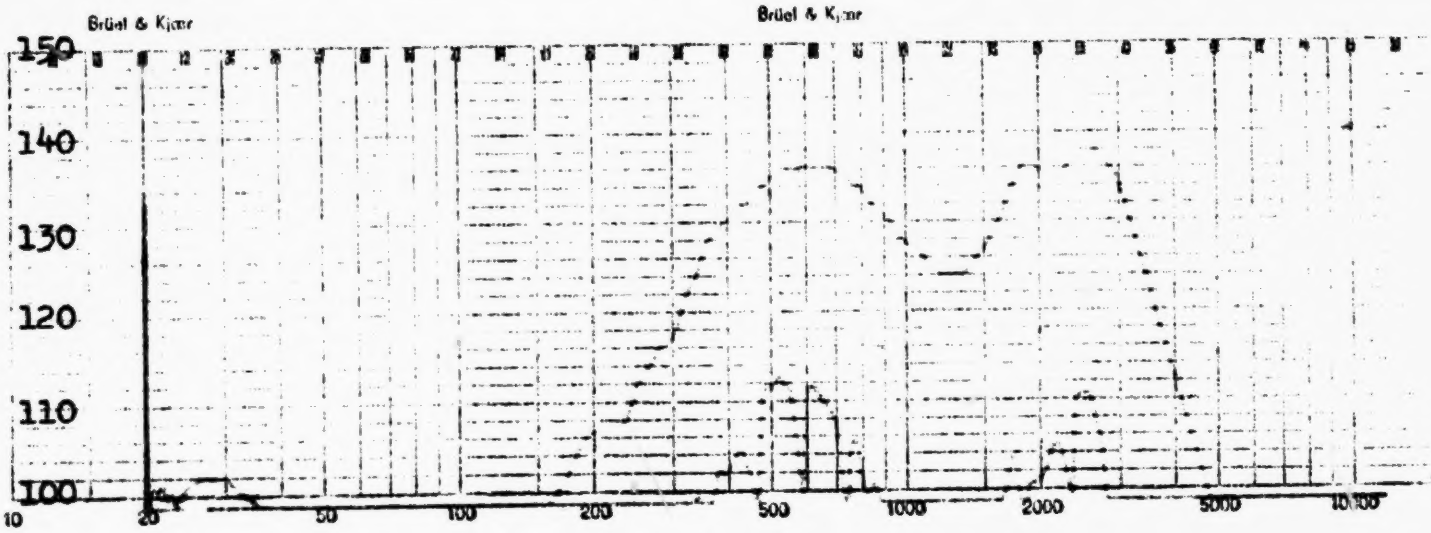


Figure 2 - Second Harmonic distortion with insert type earphones. Input of 70 dB. Right gain control set 5 dB below maximum.

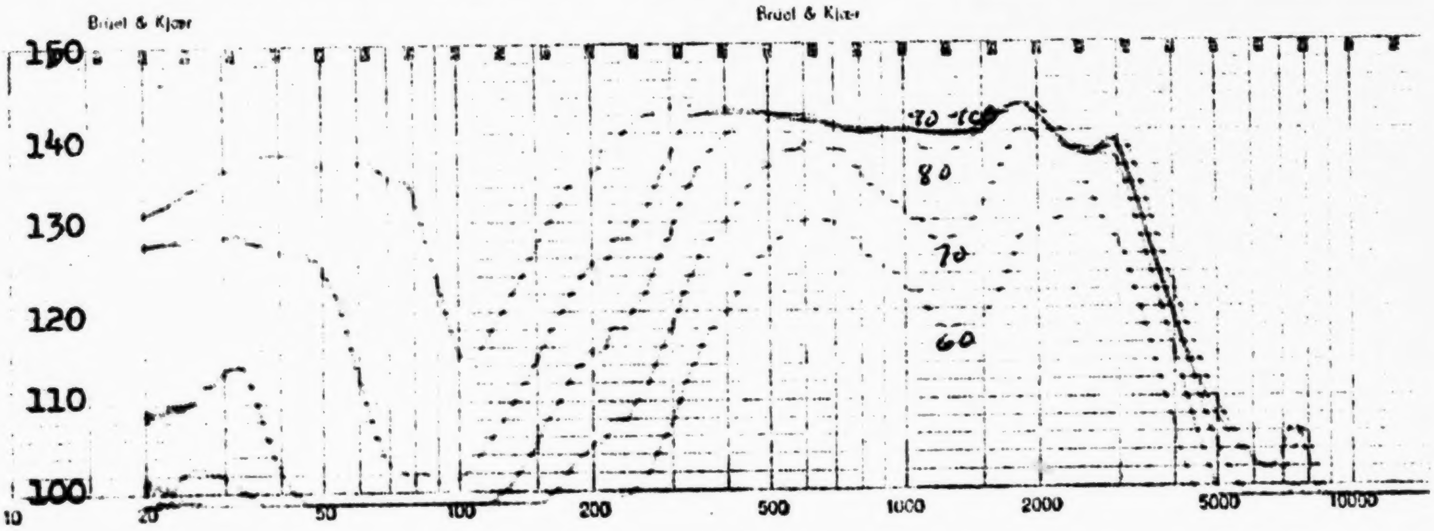


Figure 3 - Series of curves using insert type earphone. Inputs of 60, 70, 80, 90, & 100 dB. Left gain control set at maximum.

H. C. ELECTRONICS, INC.
PHONIC EAR BINAURAL AUDITORY TRAINER
MODEL 219

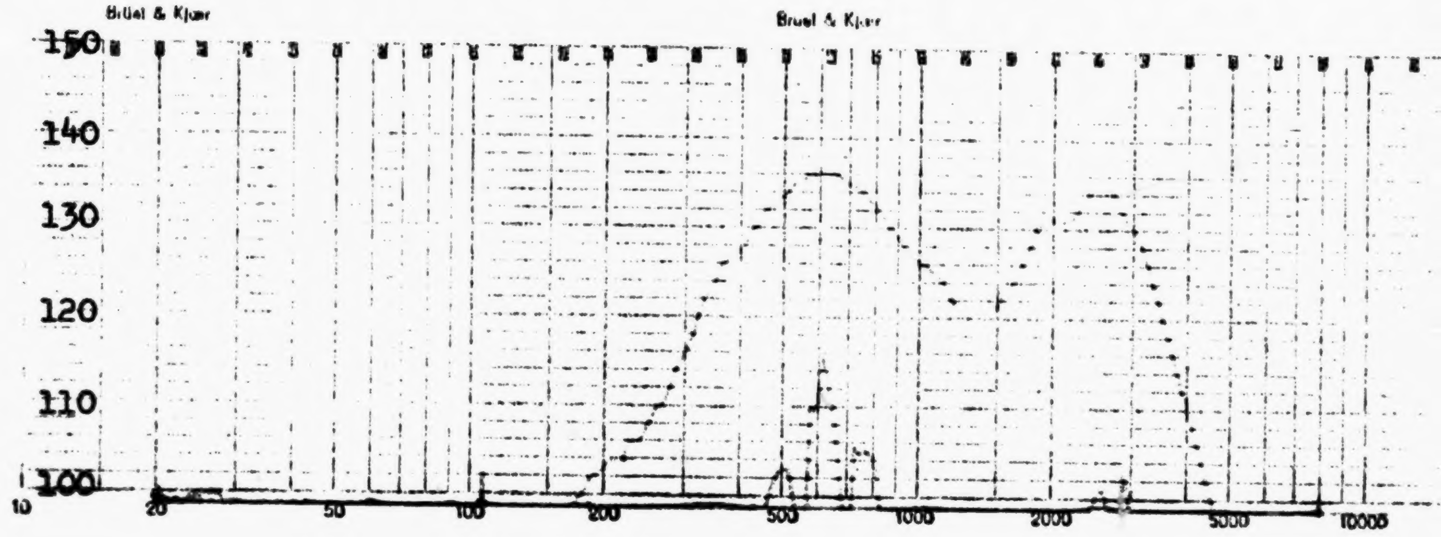


Figure 4 - Second harmonic distortion with insert type earphones. Input of 70 dB. Left gain control set 5 dB below maximum.

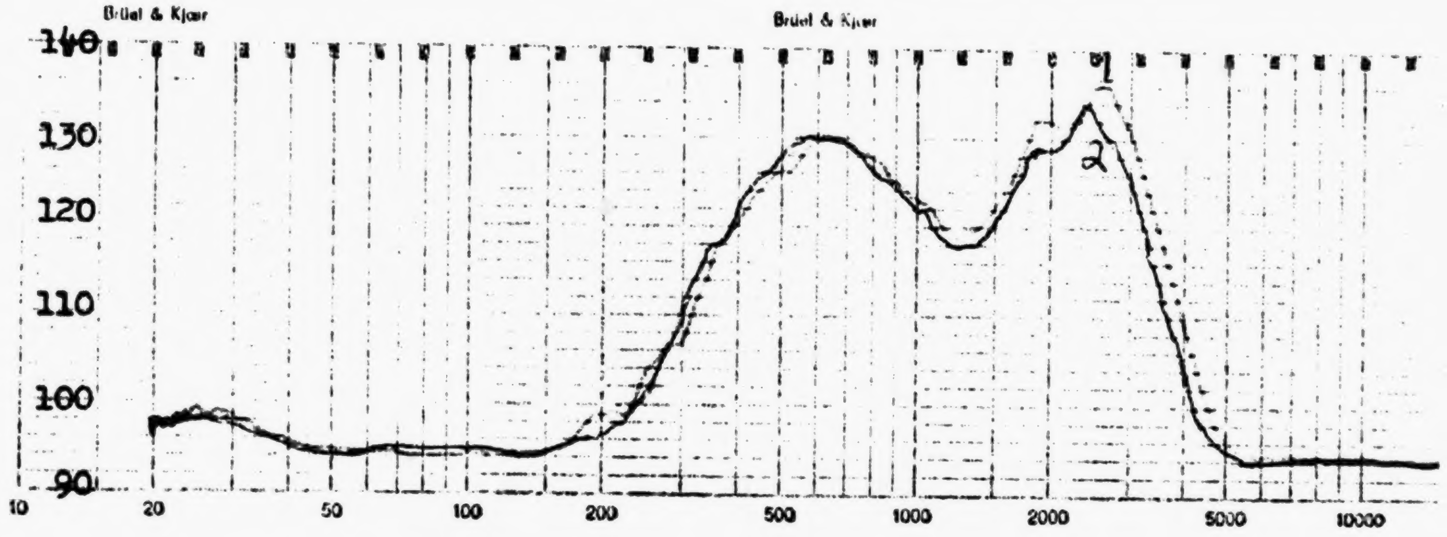


Figure 5 - Uniformity between channels using insert type earphones. Input of 60 dB. Curve 1 shows left gain control set at maximum. Curve 2 shows right gain control set at maximum.

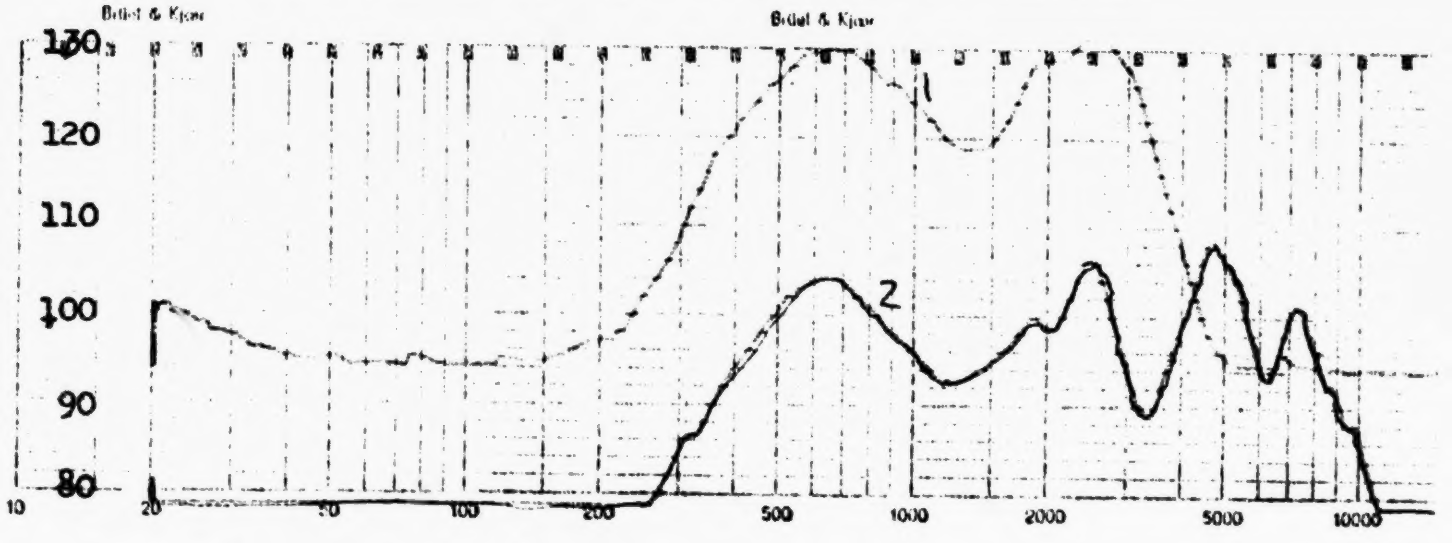


Figure 6 - Comparison of insert type earphone (curve 1) and TDH-39 muff type earphone (curve 2). Input of 60 dB. Left ear volume control set at maximum.

QUALITY ASSURANCE

H. C. ELECTRONICS HC 219

1. Case is hard plastic material; susceptibility to breakage from shock is questionable.
2. Controls are easily accessible and well marked.
3. General arrangement and accessibility of parts is good. However, leakage from batteries into circuit board area could have destructive consequences.
4. Soldering, wiring and general workmanship is good.
5. Parts are standard commercial type.
6. Service and maintainability aspects are good.

EDUCATIONAL SURVEY

H. C. ELECTRONICS HC 219

1. Physical Description

This is a self contained, wearable, binaural amplification unit. It is an AC/DC rechargeable unit. The microphones available are fixed side mounted, plug-in top mounted, or tack-on lapel microphones. Top mounted microphones make access to controls difficult. Headphones are somewhat uncomfortable. The unit is student controlled.

2. Quality

Quality is generally good. When rechargeable battery needs replacement, an electronics technician is needed.

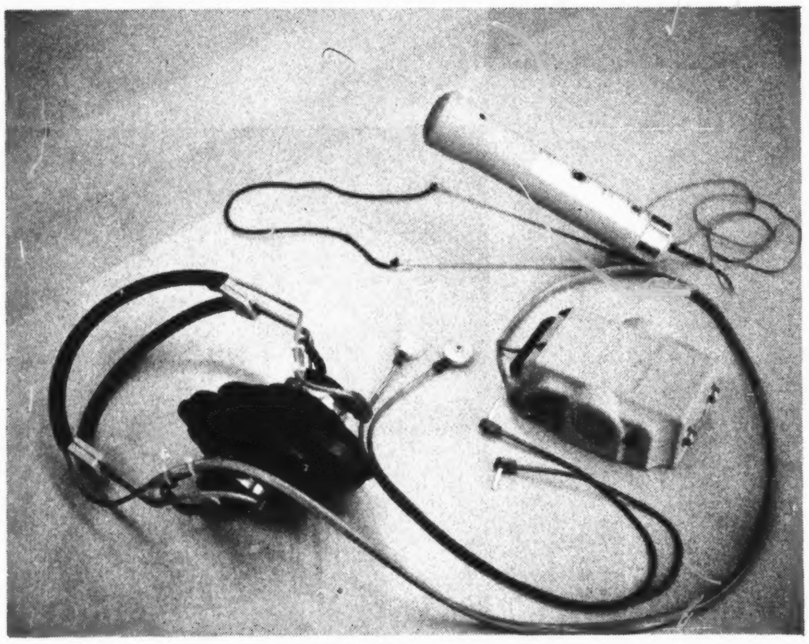
3. Performance

It is a high gain instrument with a satisfactory frequency range. It has an undesirable dip in the critical speech range.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

H. C. ELECTRONICS



AUDITORY TRAINER

221R

H. C. ELECTRONICS

221R

ACOUSTICAL RESPONSE

H. C. ELECTRONICS 221 R

Frequency response uniformity of the student unit only using insert earphones is good, as the only deviation is a 5 dB rise between 1500 and 3000 Hz. With the teacher unit broadcasting to the student unit, Figure 4, we found a narrow 6 dB dip centered around 1600 Hz. A final drop off occured at 2300 Hz which provides for a fair to good rating.

Harmonic distortion is very low with a maximum of 4.5% being recorded at 500 Hz for the student unit only. See Figure 2. With the teacher unit broadcasting to the student unit, the distortion rose very slightly to 6.3% at 700 Hz. The rating in this case was low distortion. See Figure 5.

Uniformity between channels, Figure 3, was excellent as two dB separation was not exceeded.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
student receiver only	64	280 - 4300	141
teacher unit to student receiver	49	170 - 3800	141

H. C. ELECTRONICS, INC.
Model 221 R
Student Unit only, using insert earphones

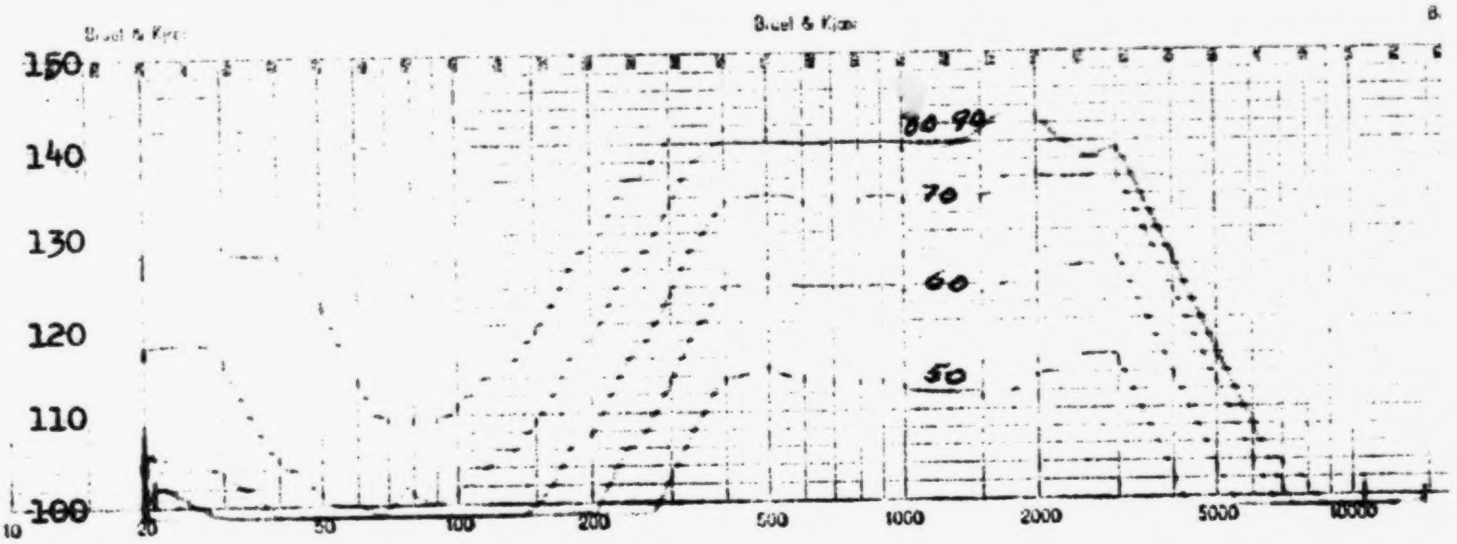


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, & 90 dB. Gain control set at maximum.

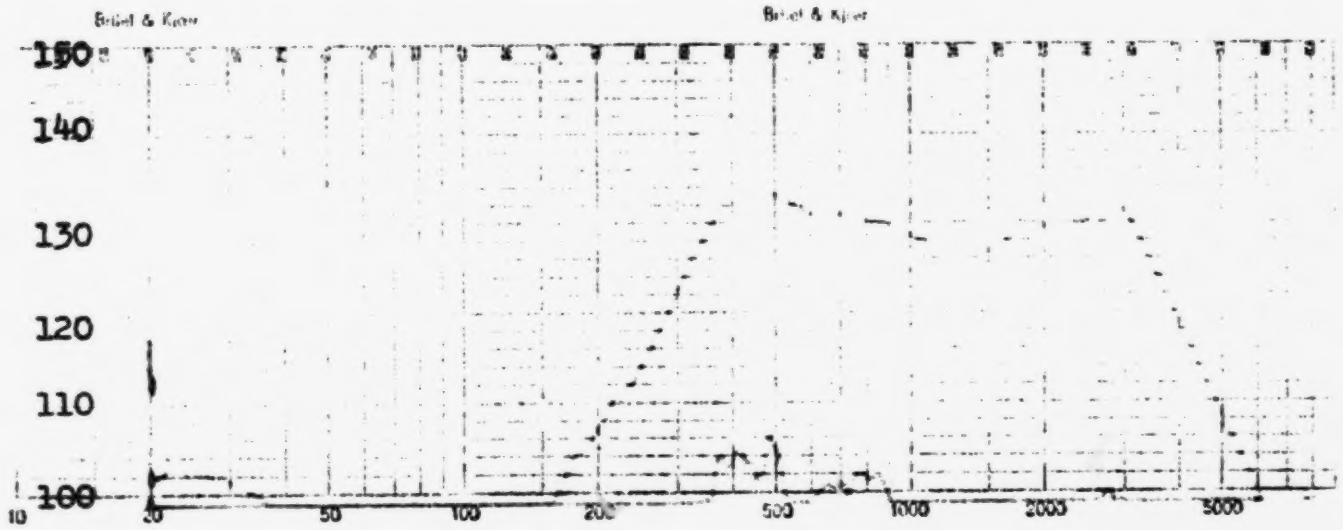


Figure 2 - Second Harmonic distortion with an input of 70 dB. Gain control set at 5 dB below maximum.

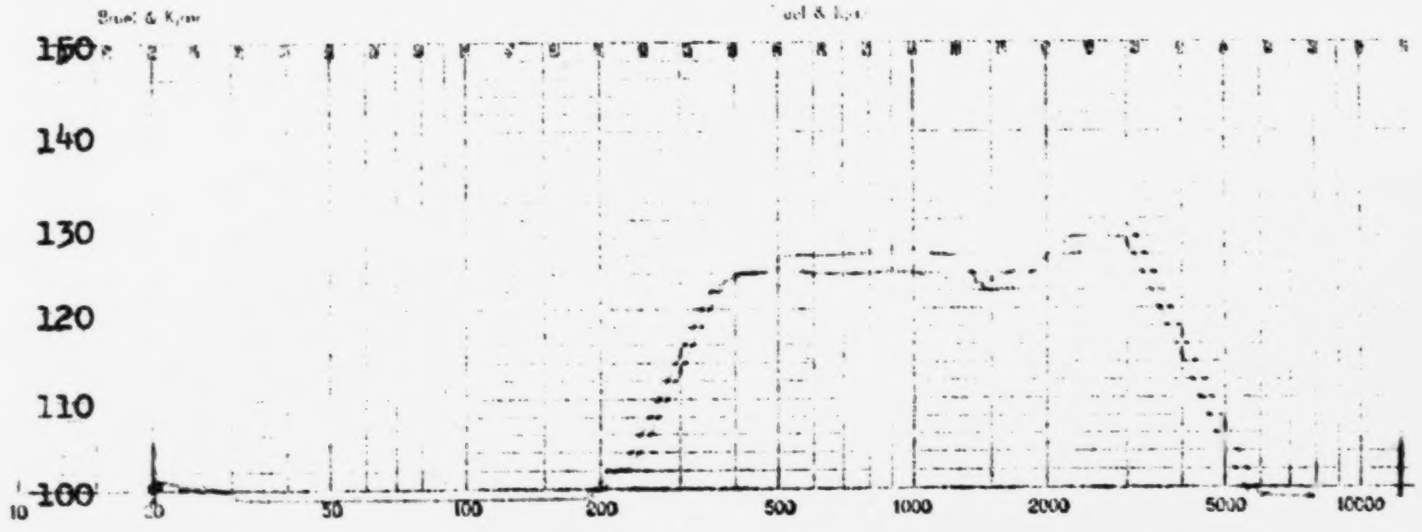


Figure 3 - Uniformity between channels with an input of 60 dB. Gain control set at maximum.

H. C. ELECTRONICS, INC.
Model 221 R
Teacher Transmitter broadcasting to Student Receiver, using insert earphones.

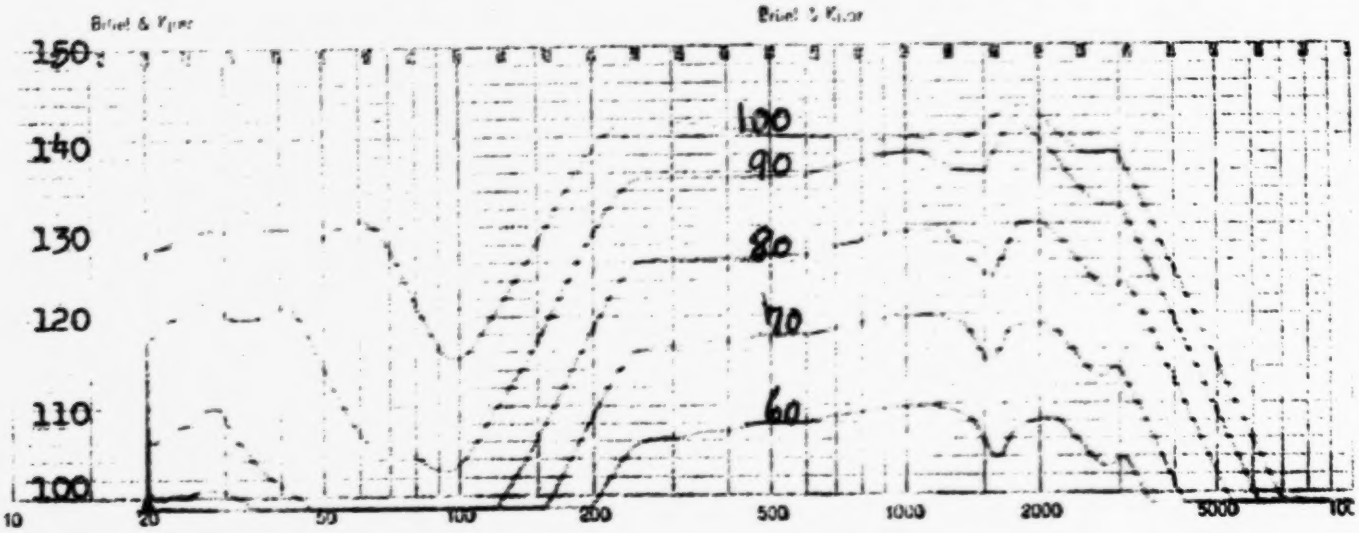


Figure 4 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB. Gain control set at maximum.

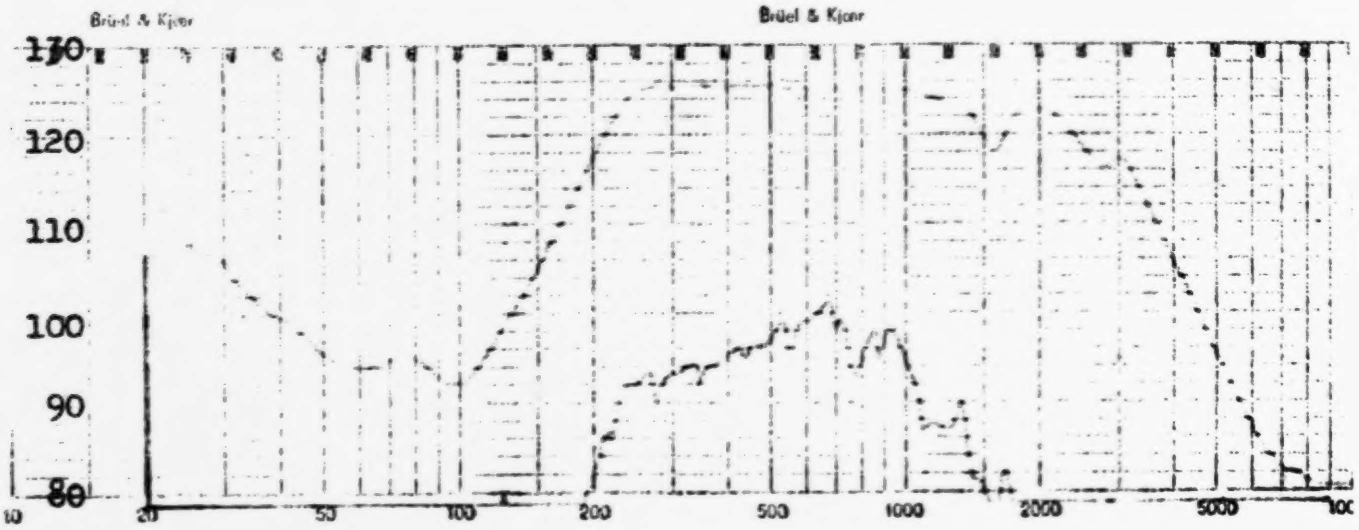


Figure 5 - Second harmonic distortion with input of 80 dB. Gain set at 5 dB below maximum.

QUALITY ASSURANCE

H. C. ELECTRONICS 221 R

This unit was received too late to be evaluated for Quality Assurance.

EDUCATIONAL SURVEY

H. C. ELECTRONICS 221 R

1. Physical Description

This model is a binaural R. F. free field, wireless,licensed FM system allowing for complete mobility of both students and teacher. It has DC power with rechargeable batteries. The teacher lavalier microphone is somewhat large with an external antenna. The mike allows for direct electrical coupling with tape recorded, record player, etc. The student mikes are contained within the student unit. The teachers microphone is controlled by the teacher and the student microphone by the student. It comes with ten color-coded crystal oscillators which plug into the receivers to change the receiving frequency. Thus each room has its own color-coded oscillaor, so each student need only insert the oscillator for the room he is in, matching the teacher's microphone.

2. Quality

Quality is generally good. When rechargeable batteries need replacement, such replacement should be made by an electronics technician.

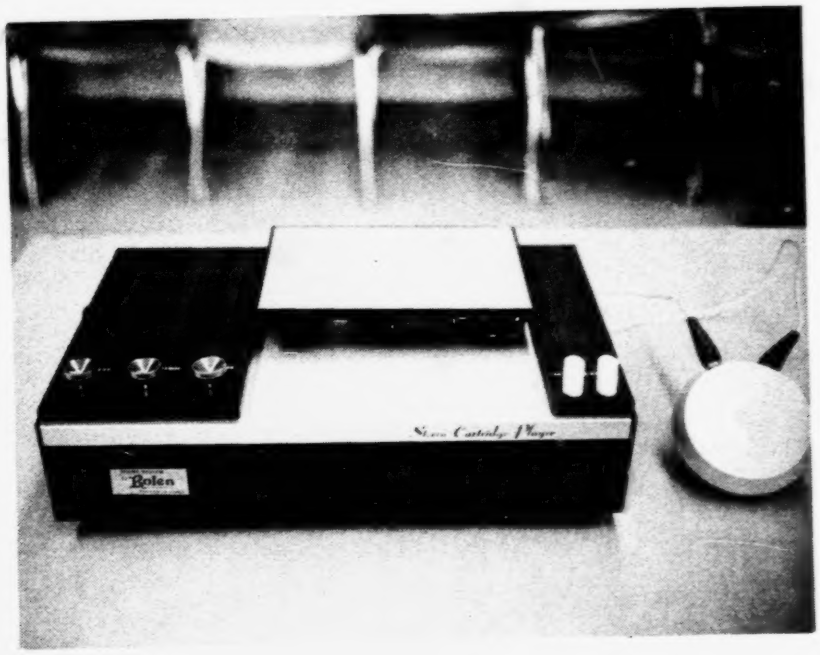
3. Performance

The gain frequency response and uniformity were good to excellent and the harmonic distortion was very low. When batteries are low, there is considerable distortion.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

ROLEN STAR


Stereo Cartridge Player
Rolen

STEREO CARTRIDGE PLAYER

QUALITY ASSURANCE

ROLEN STAR TAPE PLAYER

1. Anodized metal and plastic. Good serviceability.
2. Controls are well arranged; however, markings are not easily understood.
3. General arrangement of parts is fair. Soldering on circuit board is poor. Solder is excessive and in places the copper laminate has been overheated. Solder flux has not been removed. Workmanship is only fair.
4. Parts are foreign.
5. Service and maintainability is poor in view of the above observations.

ROLEN STAR TRANSDUCER

1. Hard plastic sealed case. Good serviceability.
2. No controls.
3. Internally the only parts are a coil of wire on a magnetic core. Soldering is good, as well as the workmanship.
4. Parts are standard commercial type.
5. Service and maintainability are good.

EDUCATIONAL SURVEY

ROLEN STAR TRANSDUCER

1. Physical Description

This is a sound transducer for solids; a means of causing structural solids to reproduce sound, and to reproduce sounds of voice and music (mono or stereo) with good quality and clarity. It can be used as a primary or auxiliary source of sound. It is omni-directional. The instrument is four inches in diameter, and one and one half inches thick. The outer surface is durable plastic. The weight is two pounds. The Rolen Star can be connected to a sound source in the house or classroom. Most AM/FM receivers, T.V. and phonographs with stereo or monaural amplifiers have adequate audio power to operate it. The mounting surfaces suggested are: Gypsum wallboard, wood floors, plywood, plaster or lath, hardboard, glass or formica. Brick, stone, laminated beams and concrete are not recommended.

2. Quality

Unit appears to be of rugged construction. Unit is connected to amplification unit by two wires and affixed to the sounding surface by a screw.

3. Performance

Performance characteristics will be influenced by the performance characteristics of the source of amplification.

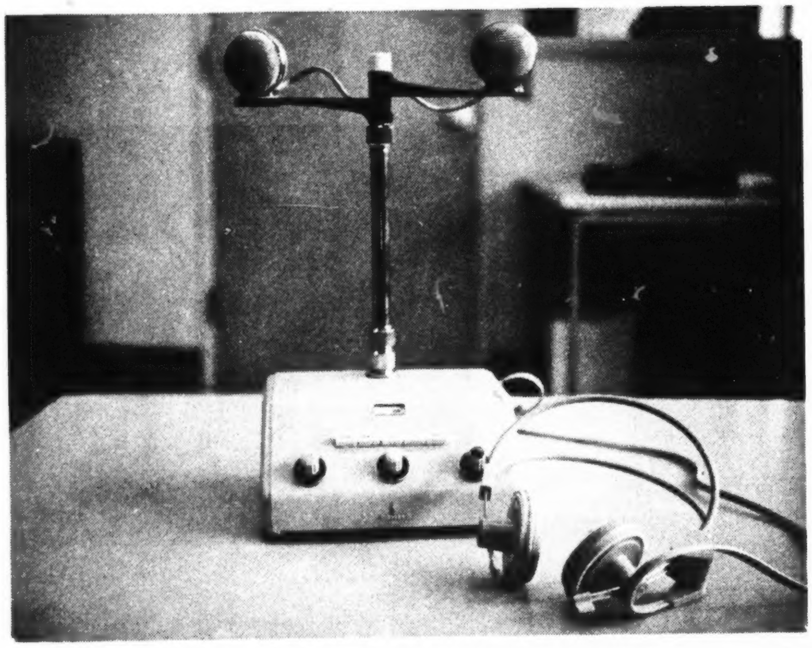
4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

The instrument could be used in aural communication procedures involving hearing impaired children. The tactile stimulation and amplified sound would provide another channel for language and speech development and improvement. The availability of music and rhythms would not only provide supplementary speech and language skills, but should prove to be a pleasurable experience.

For this study a Rolen Star Stereo Tape Player was used to drive the transducer.

SIEMENS



AUDITORY TRAINER

DT96R

SIEMENS

DT96R

ACOUSTICAL RESPONSE

SIEMENS

Frequency response uniformity, Figure 1, using Siemens earphone with the pad attachment is considered fair. The 12 dB dip through the speech range cannot be considered as desirable at this time; however, some research in this area may show our reasoning to be wrong. Compensation such as this is often times seen in Hi Fi's where a presence control is used. Emphasis in the low and high frequencies is then used at low listening levels in order to compensate for the loudness balance characteristics of the normal ear.

Using the muff attachment on the Siemens earphone, we found even more emphasis in the low frequencies but less in the highs.

Harmonic distortion, Figure 2, when using the instrument according to the instructions was low. However, if the monitor meter was allowed to exceed the red line,distortion was present in ever increasing quantities.

Tone control variability was rated as good according to our test criteria. There are four positions of tone variability available on this instrument.

Power output control calibration was excellent. The steps were uniform and related closely to the levels reported in the manual. (see Figure 5.)

The AVC circuit showed good separation between curves, Figure 6, allowing for high gain settings without distortion. However, the compression attack and recovery time was poor. The attack time was found to be 500 milliseconds with an overshoot of 10 dB. The recovery time took 2000 milliseconds (2 seconds) to complete; however, in the recovery sequence only a 3 dB undershoot occured which doesn't cause the long recovery time to be too critical. The overall rating for this function was considered to be poor. (see Figure 8.)

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
regular	37 *	100 - 8000	127
AVC	48	100 - 9000	121

* Gain was set according to the manual and that which is stated in Figure 1. At least 20 more dB of gain is available in the instrument.

SIEMENS

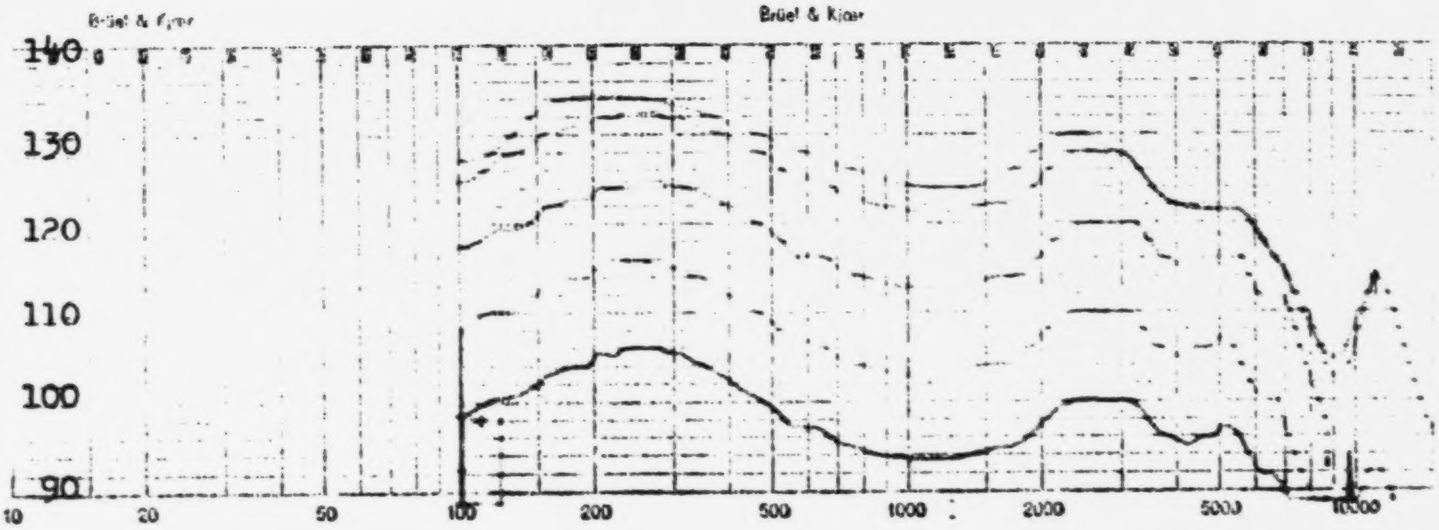


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, 90, & 100 dB. Gain control set at meter red line at 1000 Hz with 80 dB input. Output level control set at maximum.

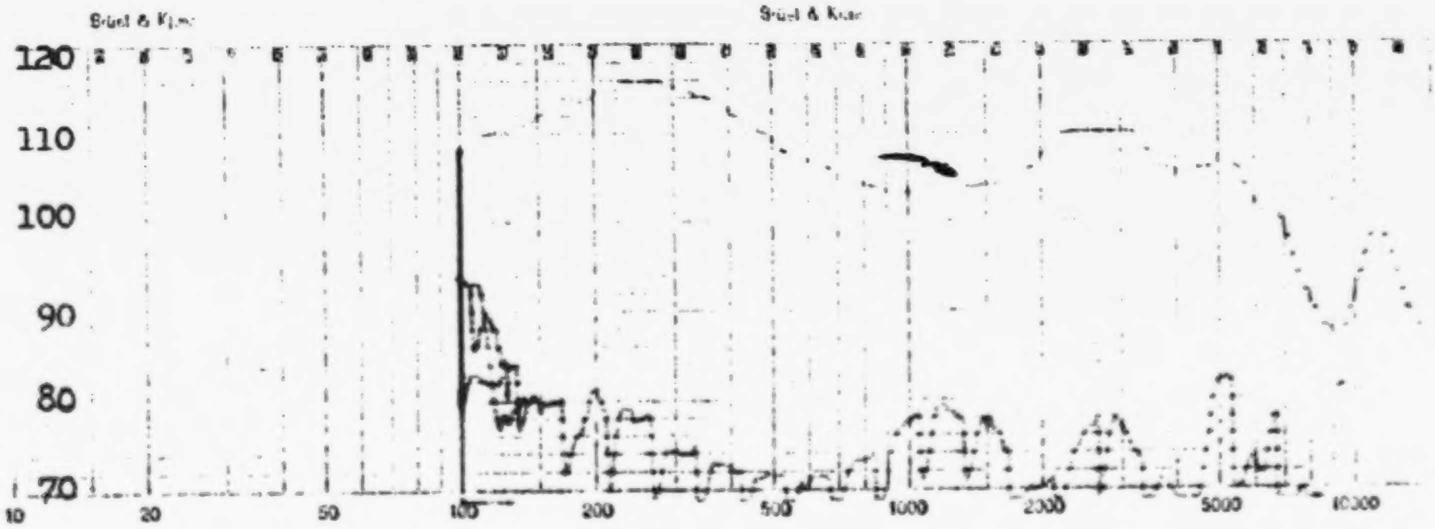


Figure 2 - Second Harmonic distortion. Input of 70 dB. Gain control set at meter red line at 1000 Hz with 80 dB input. Output level control set at maximum.

SIEMENS

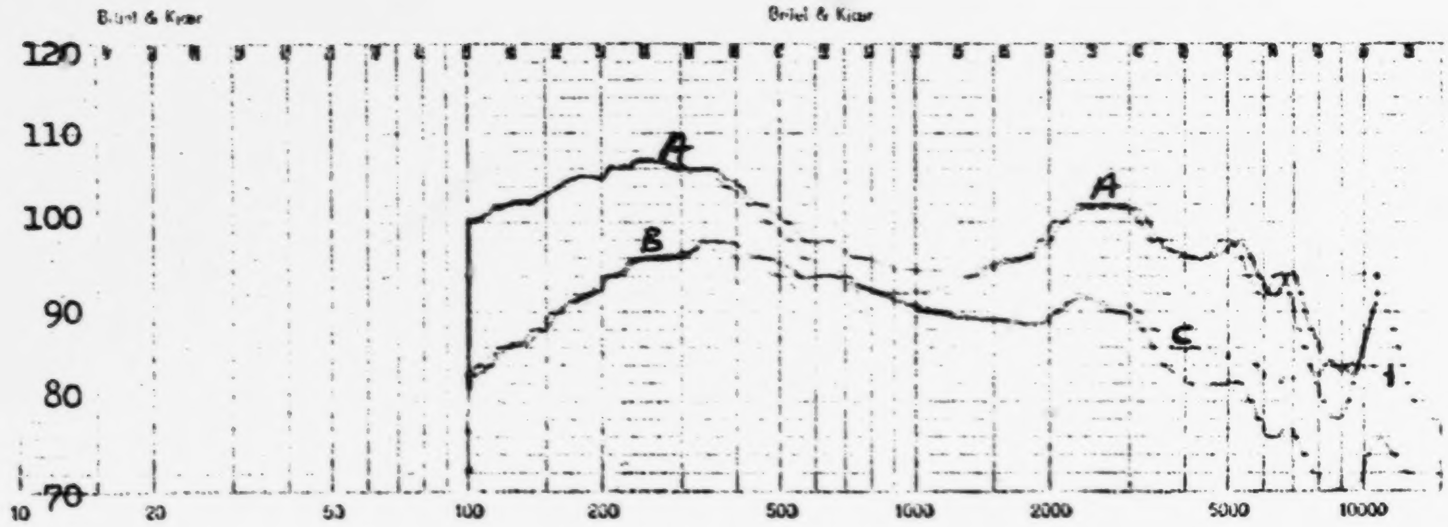


Figure 3 - Effect of changing frequency response adjustments. Input of 60 dB. Gain control set at meter red line at 1000 Hz with 80 dB input. Output level control set at 11. 1) B-A curve = H button in. 2) A-C curve = L button in. 3) B-C curve = both L and H button in. 4) A-A curve = normal with both L and H button up.

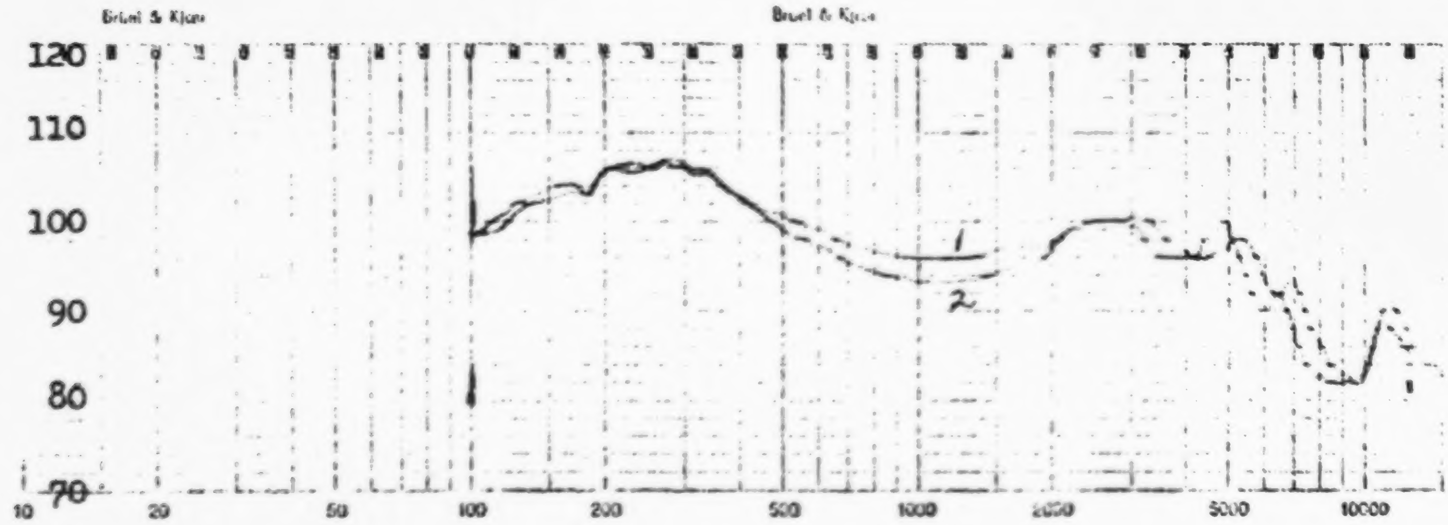


Figure 4 - Comparison of right (1) and left (2) channels with input of 60 dB. Gain control set at meter red line at 1000 Hz with 80 dB input). Output level control set at maximum.

SIEMENS

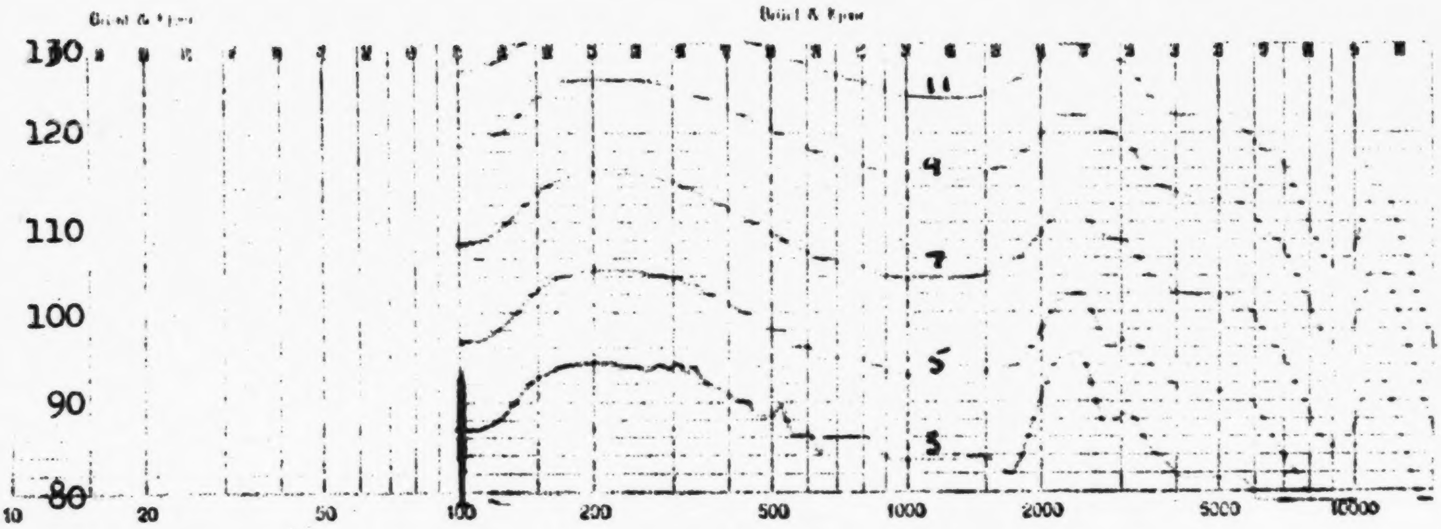


Figure 5 - Series of curves showing effect of output level control. Input of 100 dB. Gain set at meter red line at 1000 Hz with 80 dB input. Output level control positioned at 3, 5, 7, 9, & 11.

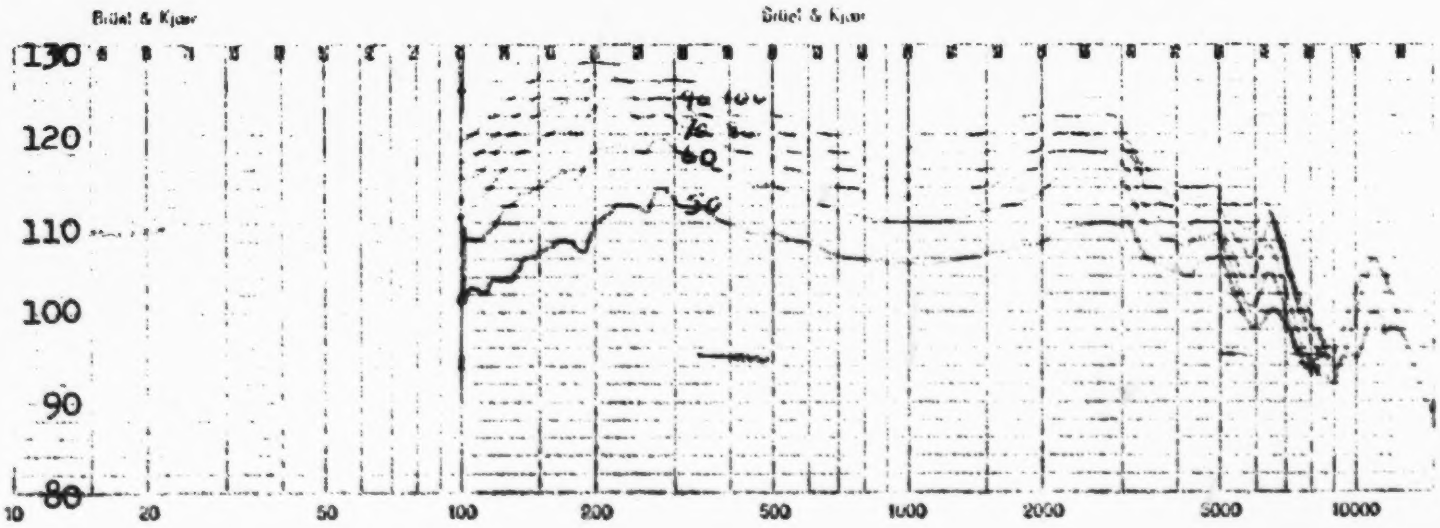


Figure 6 - Series of curves with AVC in operation. Input of 50, 60, 70, 80, 90, & 100 dB. Gain control set at meter red line at 1000 Hz with 80 dB input. Output control set at 11.

SIEMENS

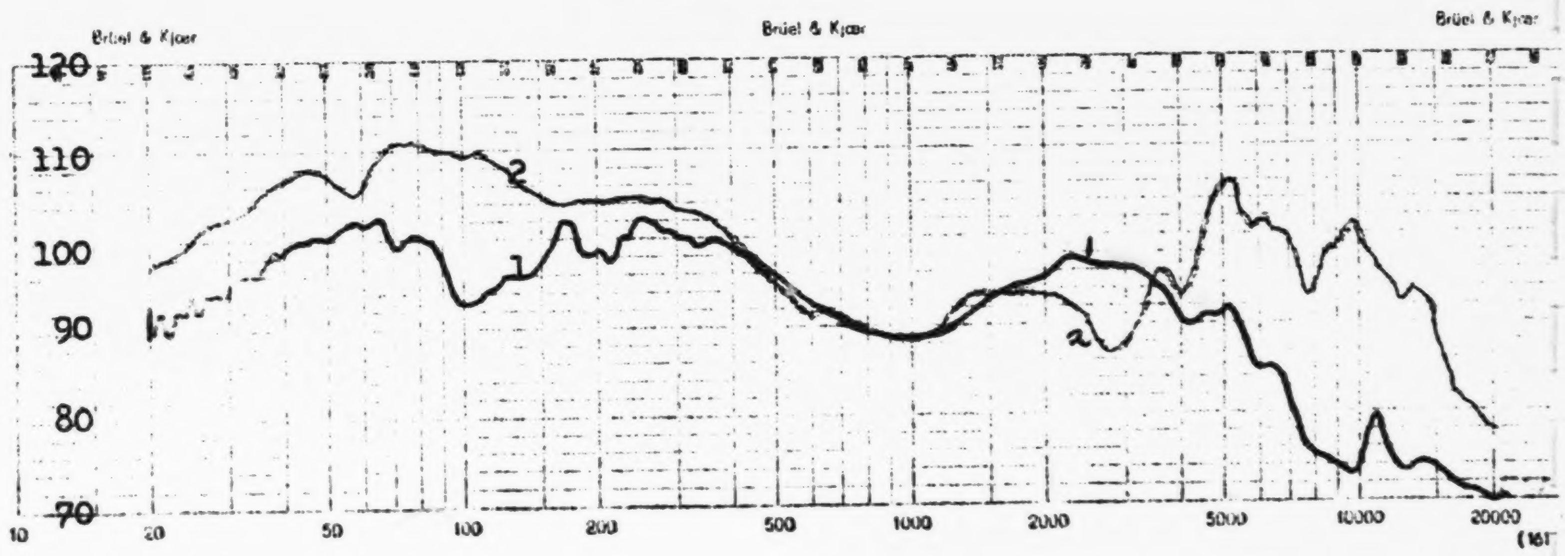


Figure 7 - Comparison of earphone with cushion (1) vs. muff (2). Input of 60 dB. Gain control set at 7, output level control set at full.

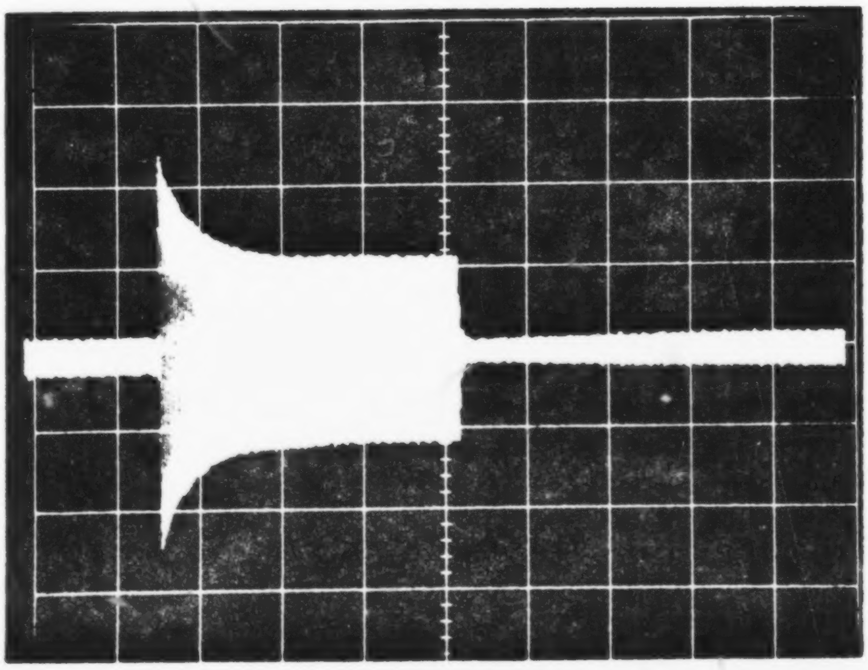


Figure 8

Attack and release times of compression sequence. Input of 60-80-60 dB. Gain control set at meter red line at 1000 Hz with 80 dB input. Output control set at 11. Base line calibration 0.5 sec/div.
60 dB input = 88 dB output.
80 dB input = 103 dB output.
Attack overshoot 10 dB.
Attack undershoot 0 dB.
Recovery undershoot 3 dB.
Attack time 500 ms.
Recovery time 2000 ms.

QUALITY ASSURANCE

SIEMENS

1. Case is enamelled metal with internal metal component mounting frame. Good serviceability.
2. Control arrangement and markings are good.
3. The general arrangement of internal parts is such as not to permit ready access to parts without extensive dis-assembly.
4. General workmanship, soldering and wiring are good.
5. Parts are apparently foreign made.
6. Service and maintainability of this unit would be handicapped by virtue of its foreign origin. Parts replacement would be the greatest problem.

EDUCATIONAL SURVEY

SIEMENS

1. Physical Description

The Siemens stereo individual desk top trainer DT96R has an automatic switch with a volume control. The power output control was rated excellent. The unit can be used either as stereo or monaural. It is a portable unit operated by DC power with two replaceable 1½ volt batteries. This unit is not easily carried. The microphone, which is used by both student and teacher, is fixed to the unit. Headphones are light weight, comfortable and adjustable. The muff attachment is unsatisfactory. The cord plugs into the head set. The teacher or pupil has operational responsibility, and controls are relatively simple.

2. Quality

Because of foreign manufacturer, maintenance and securing parts may present difficulties.

3. Performance

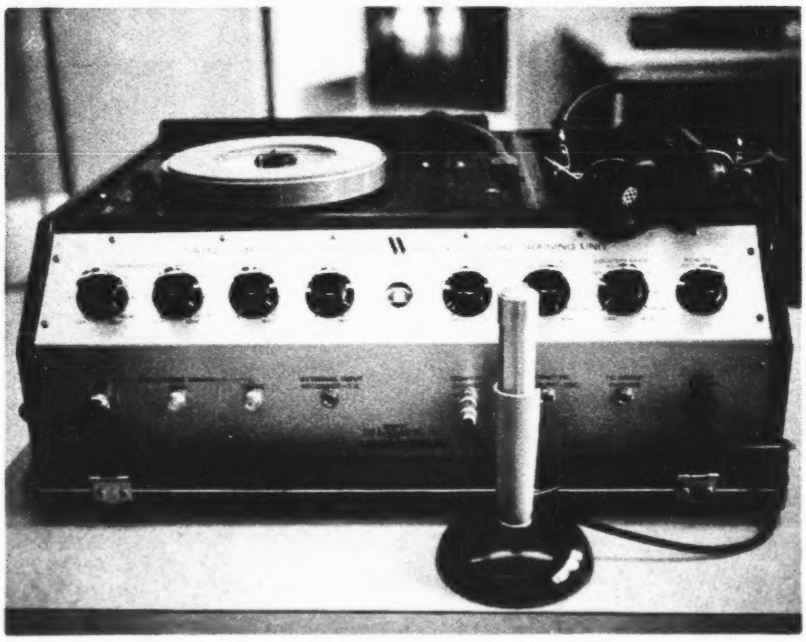
While frequency range is extensive, the gain is relatively low. Frequency response in the upper speech range drops in an unsatisfactory manner. Harmonic distortion and compression attack time are unsatisfactory. During test trials, it was impossible to operate the instrument at full power because of feedback.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

This unit is not recommended when maximum gain is desired.

WARREN



AUDITORY TRAINER CONSOLE

T2

ACOUSTICAL RESPONSE

WARREN T2

Frequency response uniformity, Figure 1, was found to be fair by our rating criteria. There was found to be a 9 dB valley centered at 1700 Hz followed by a sharp 12 dB rise and another 10 dB valley.

Harmonic distortion was found to be very low.

Uniformity between channels was found to be excellent as no more than a 2 dB variation occured. (see Figure 5.)

Gain control calibration was excellent; however, the numbering on the dial plate might be confusing to some users. (see Figure 3.)

Power output control calibration was only fair as the acoustic outputs we measured were 10 dB lower on the average than the dial plate markings. (see Figure 4.)

The two microphones supplied with the trainer provides for different response characteristics as shown in Figure 6.

Compression action was rated as poor. Attack time was 1100 milliseconds with a 4 dB overshoot and an 8 dB undershoot. Recovery time was 900 milliseconds with an 8 dB undershoot. (see Figures 7 & 8.)

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
J. L. Warren earphones with cushion	53	160 - 7800	130

WARREN T-2

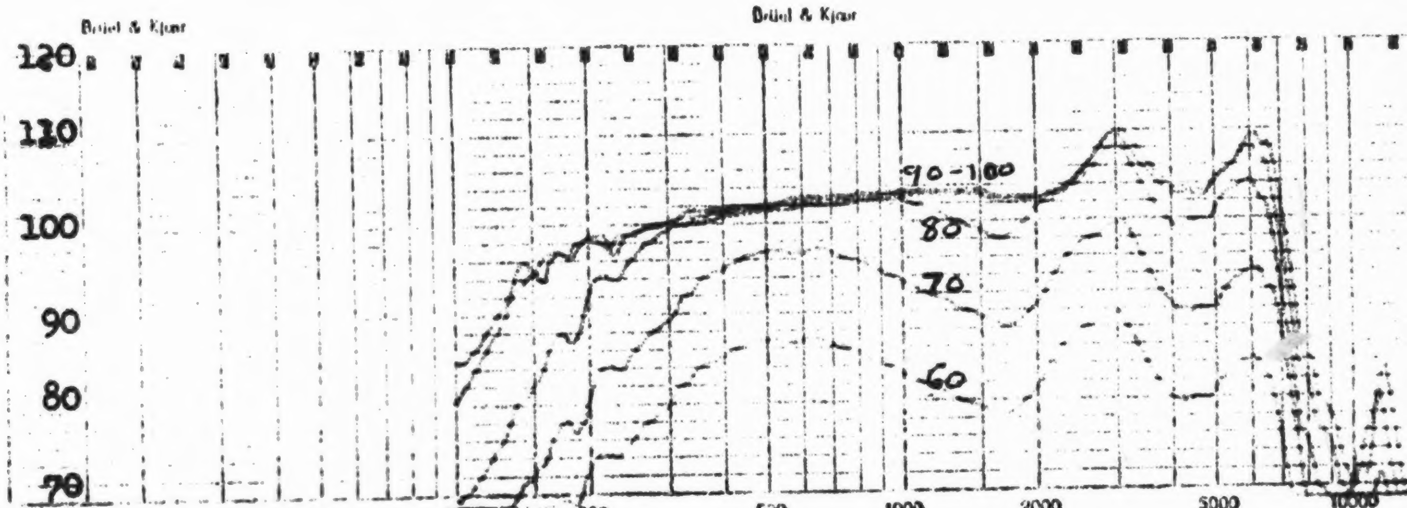


Figure 1 - Series of curves with inputs of 60 dB to 100 dB, mic. sensitivi
set at maximum (35 dB), and binaural control set at 110 dB (MPO

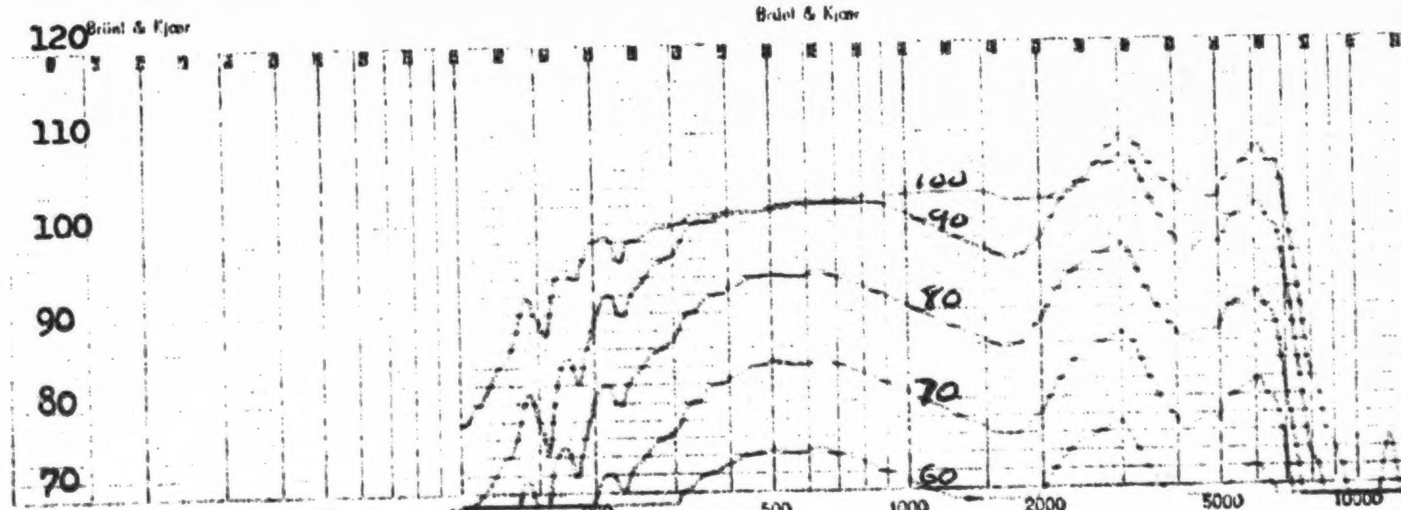


Figure 2 - Series of curves with inputs of 60 dB to 100 dB showing the effect of changing the mic. sensitivity control to 45 dB, i.e. down 10 dB. Binaural control set at 110 dB (MPO).

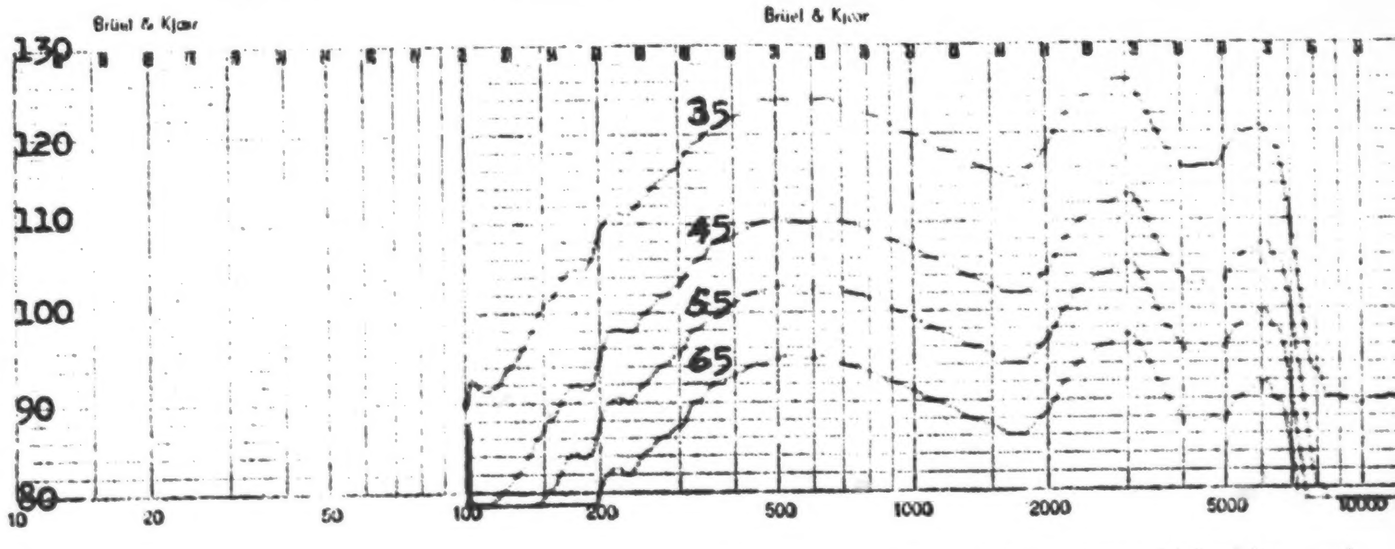


Figure 3 - Linearity of mic. sensitivity control. Mic. sensitivity set at 65, 55, 45, & 35 dB, and binaural control set at 140 dB. Input of 60 dB.

WARREN T-2

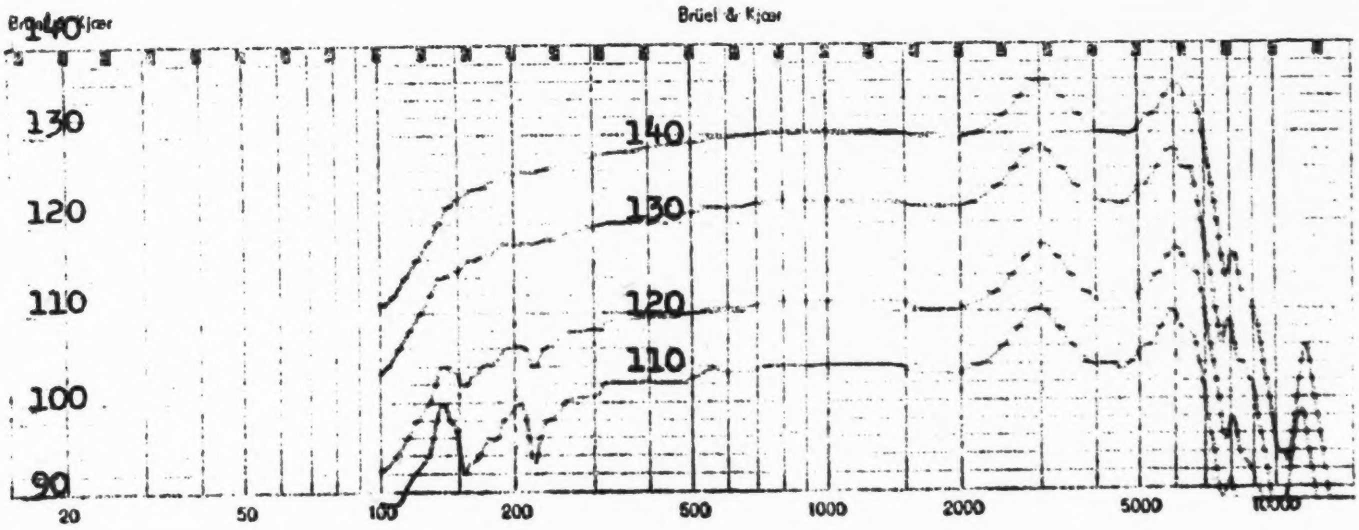


Figure 4 - Linearity of binaural control, mic. sensitivity set at maximum, binaural control set at 110, 120, 130, & 140 dB, with input of 100 dB.

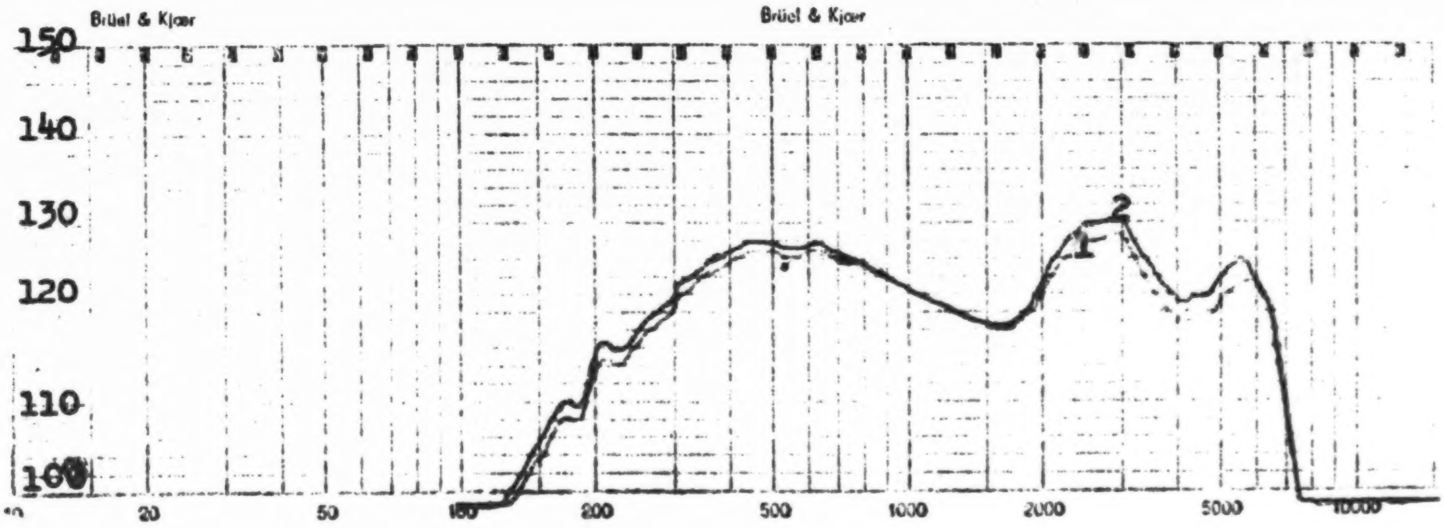


Figure 5 - Uniformity between right (1) and left (2) earphones, mic. sensitivity set at maximum, binaural control set at maximum. Input of 60 dB.

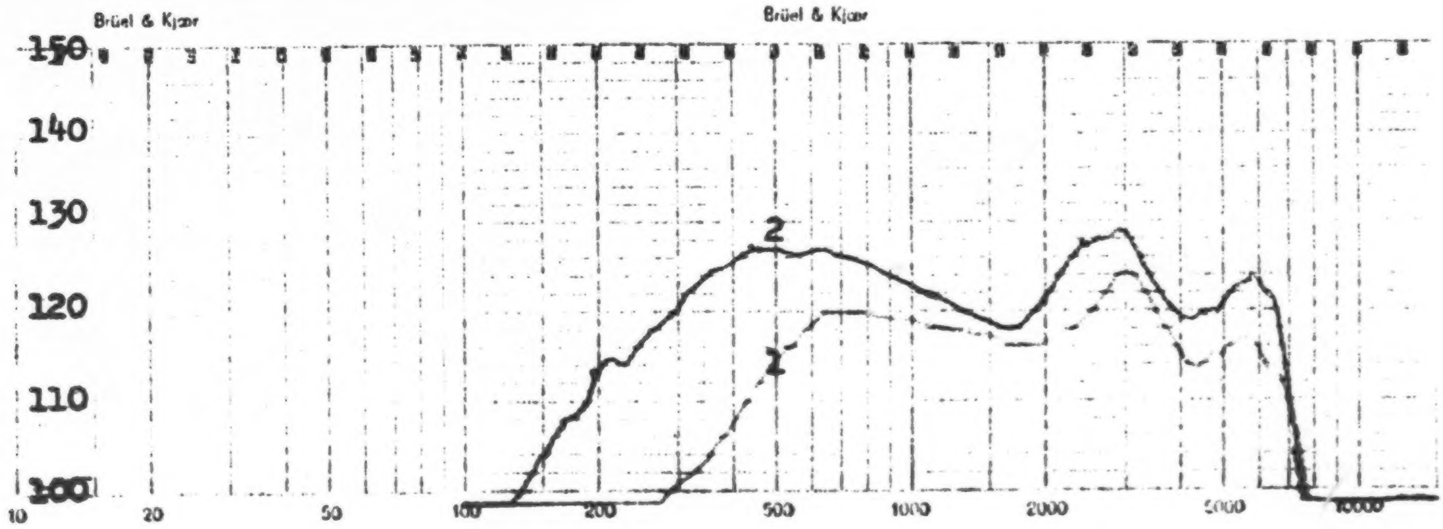


Figure 6 - Difference in response between Shure 777 mic. (1) and Astatic 335 H mic (2). Mic. sensitivity set at maximum, binaural control set at maximum. Input of 60 dB.

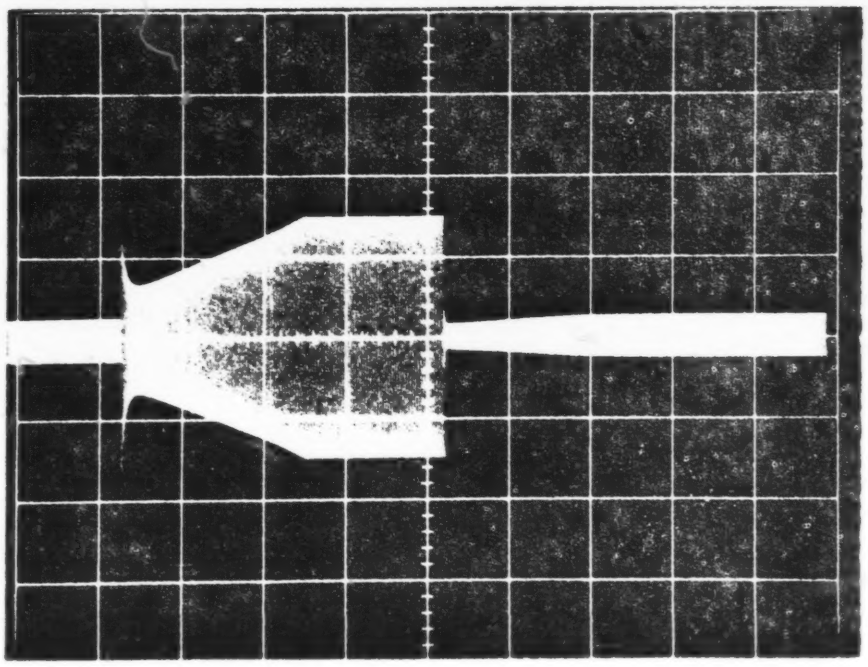


Figure 7

Attack and release times of compression sequence, mic. sensitivity set at 35 dB, binaur
control set at 140 dB. Input sequence of 60-80-60 dB. Base line calibration 0.5 sec/div.
60 dB input = 114 dB output.
80 dB input = 138 dB output.
Attack overshoot 4 dB.
Attack undershoot 8 dB.
Recovery undershoot 8 dB.
Attack time 1100 ms.
Recovery time 900 ms.

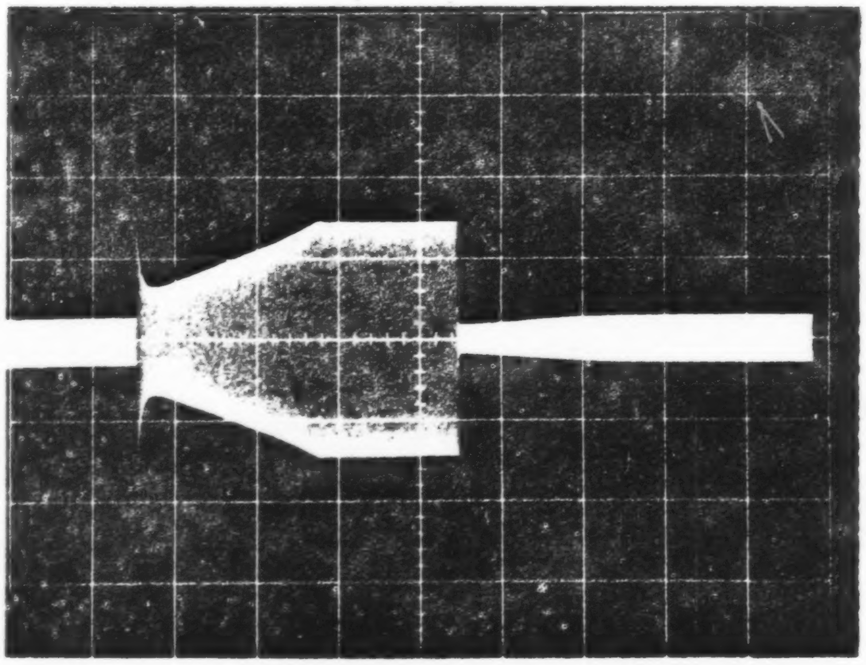


Figure 8

Attack and release time of compression sequence, mic. sensitivity set at 35 dB, binaural control set at 110 dB. Input sequence of 60-80-60 dB. Base line calibration 0.5 sec/div.
60 dB input = 87 dB output.
80 dB input = 101 dB output.
Attack overshoot 4 dB.
Attack undershoot 8 dB.
Recovery undershoot 8 dB.
Attack time 1050 ms.
Recovery time 900 ms.

QUALITY ASSURANCE

WARREN T2

1. Chassis is standard commercial radio type. Switch and control arrangement is satisfactory. Outer case is vinyl covered wood.

2. General arrangement of parts on chassis results in less congestion than the Model W-2S and therefore permits better access for service and maintainability.

3. Soldering and general workmanship are limited by the constraints of parts arrangement mentioned above. The practice of soldering tube sockets to the chassis is undersirable and could lead to maintenance problems.

4. Parts are standard commercial type.

5. Service and maintainability are poor.

EDUCATIONAL SURVEY

WARREN T2

1. Physical Description

The Warren Model T2 vacuum type monaural hard wire training system, in which a loop can be added,is supplied by AC power. This model is unusually large and quite heavy so it is best located in a fixed position. Separate volume control for each ear may be adjusted by the students on dual control mounted boxes. The teacher adjusts other controls. The teacher's microphone may be either a stand or a lavalier type. Mobility of the teacher is limited by the length of the cord. There are three microphone inputs. Two of these three microphone inputs may be utilized to accomodate five students each with student microphones which are optional equipment. The headphones are H2 receivers (TDH-39) with two head bands which are hard, uncomfortable and demonstrate little flexibility or adjustabilit The ear cushion is fairly comfortable. Servicing requires an electronics technician.

2. Quality

Workmanship on the Warren Model T2 is judged to be generally unsatisfactory. The use of vacuum tubes is generally obsolete. The turntable and tone arm are unsatisfactory.

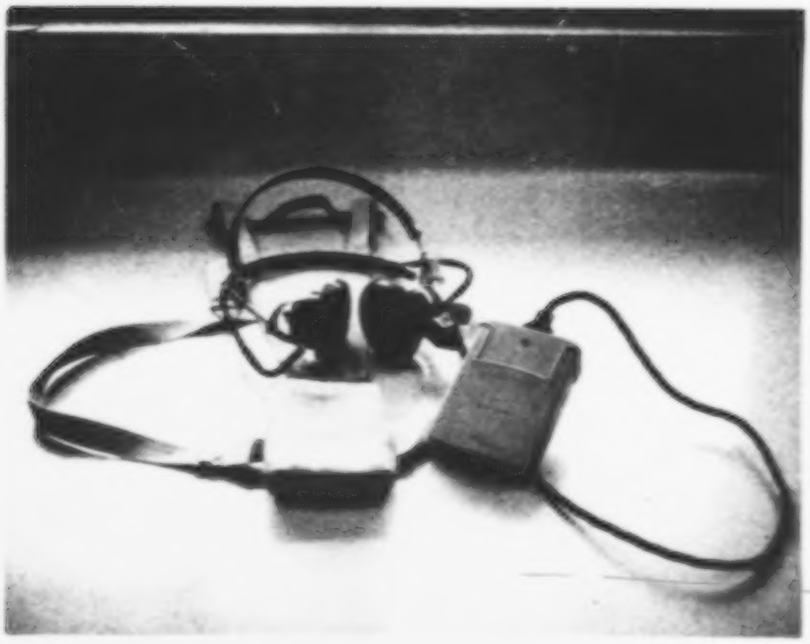
3. Performance

The performance of compression amplification circuit is unsatisfactory The use of vacuum tubes generates excessive heat which makes part of the case hazardous to touch and may warp records.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

WARREN

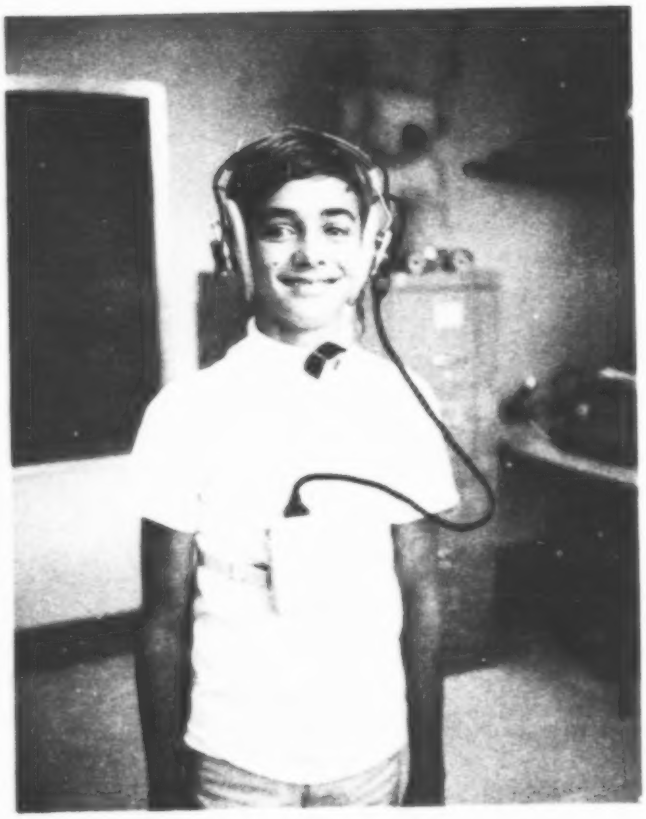


WALK-AWAY

W1

W A R R E N

W1



ACOUSTICAL RESPONSE

WARREN W1

Frequency response uniformity; of the several instruments tested there seemed to be an excessive high frequency emphasis (see Figures 2 and 4.) There was also poor uniformity of frequency response between instruments as can be seen in the three charts in Figure 4. Therefore, as far as uniformity within any one instrument is concerned they would be rated all the way from poor to good.

When used with the T2 trainer, the frequency response uniformity was rated as fair.

Harmonic distortion was found to be very low.

Figure 5 demonstrates how the frequency response varied with the different earphone microphone arrangements available with the W1.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
W1	60	200 - 5300	130
W1 and T2	57	240 - 8500	130

WARREN W-1 WALKAWAY

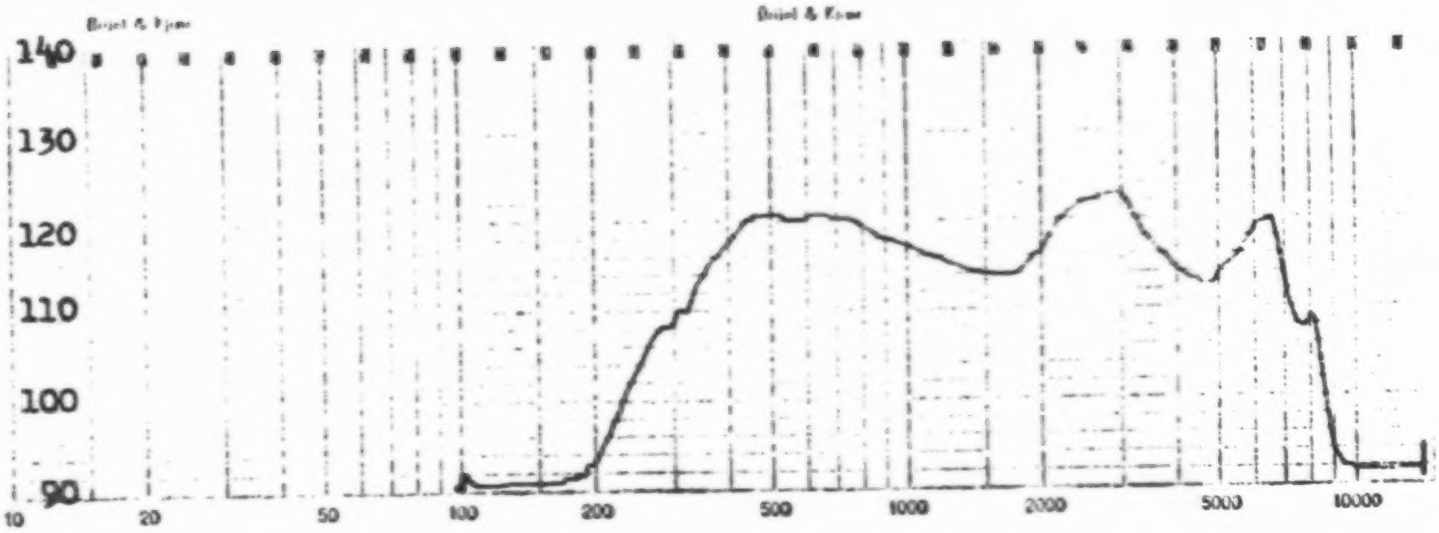


Figure 1 - Response curve of the W-1-L when used with the T2 and related magnetic loop system. Input of 60 dB. Mic. sensitivity control set at 45. W-1 gain control set at 6 and loop mic. control set at L.

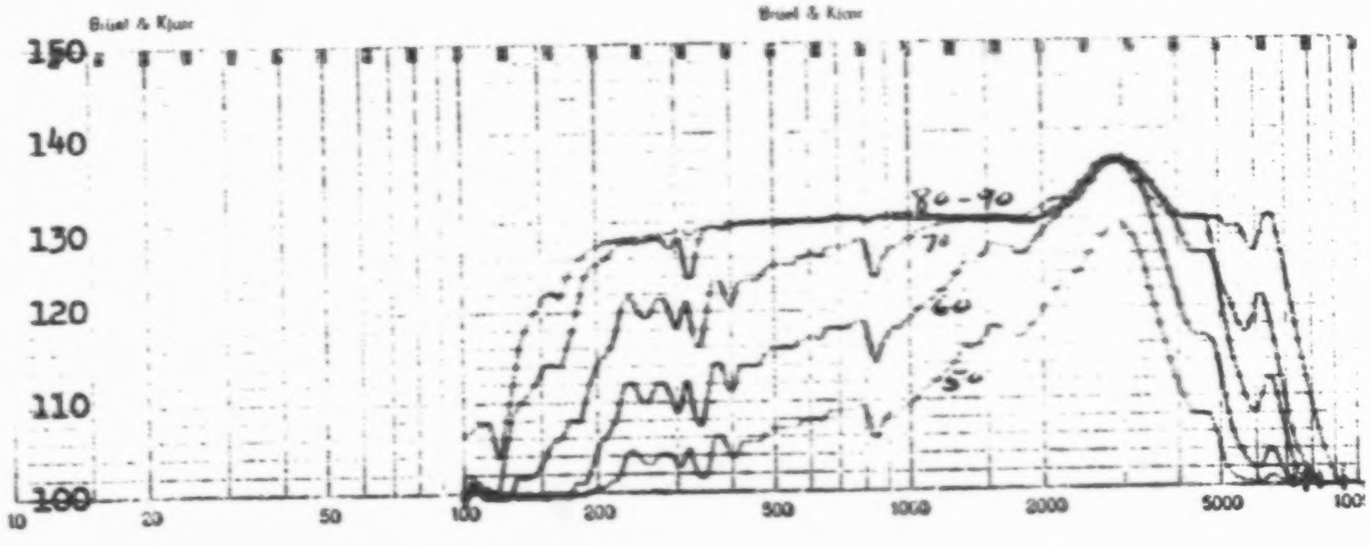


Figure 2 - Series of curves with inputs of 50, 60, 70, 80, & 90 dB of Warren W-1-L walkaway unit, using internal mic. Gain control set at maximum. Internal mic. set on M.

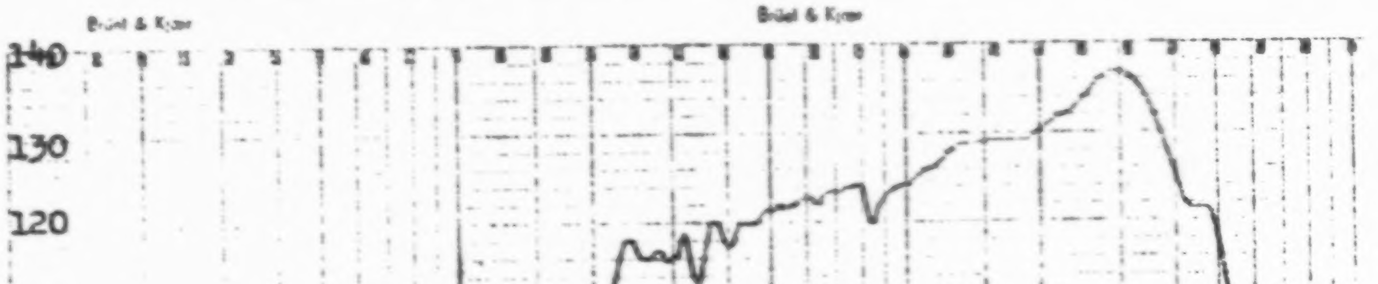


Figure 3 - Second harmonic distortion. Input of 70 dB. Gain down 5 dB below maximum.

WARREN W-1 WALKAWAY

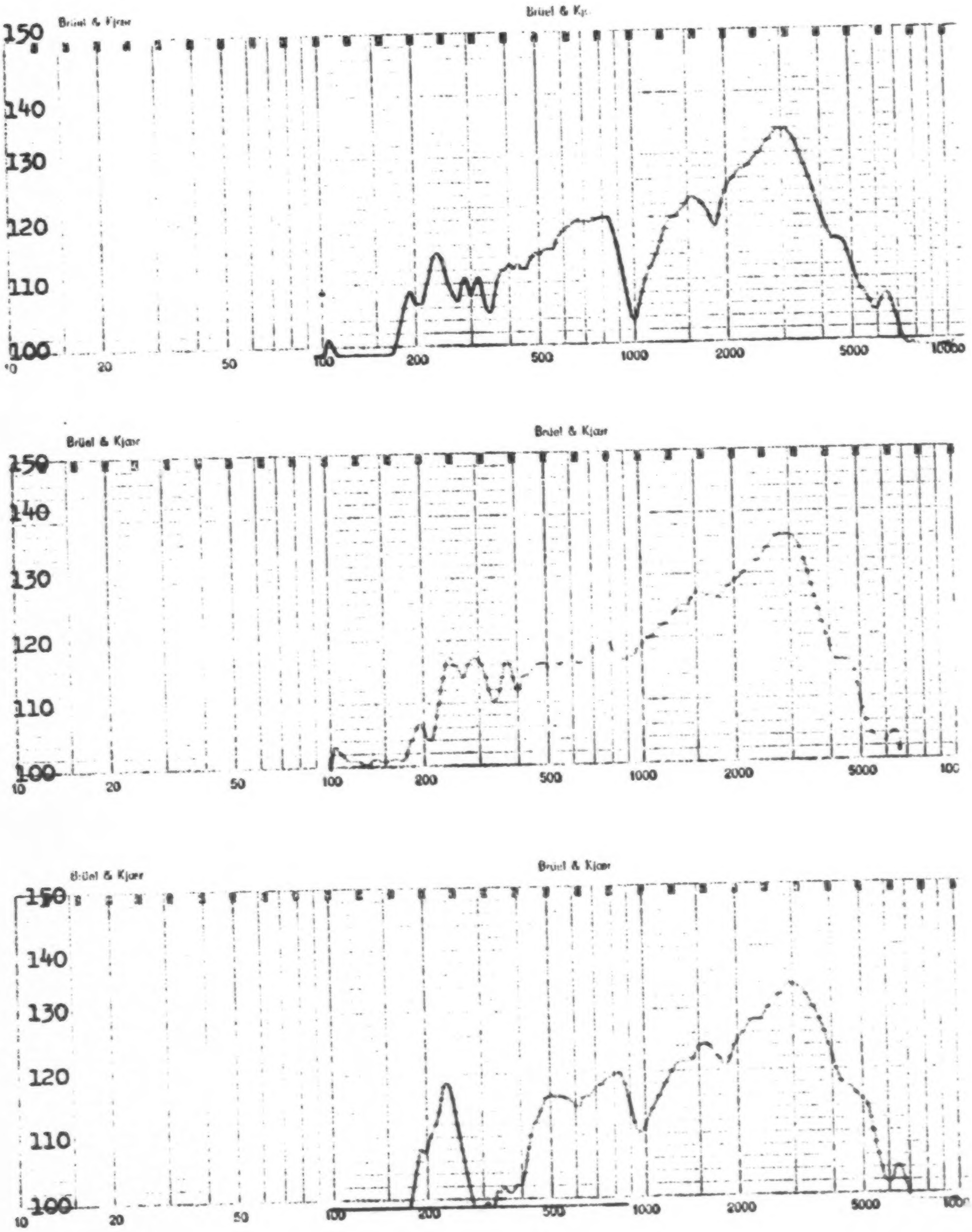


Figure 4 - Comparison of frequency responses of three units (a, b, & c.) Input of 60 dB. Gain set at maximum.

WARREN W-1 WALKAWAY

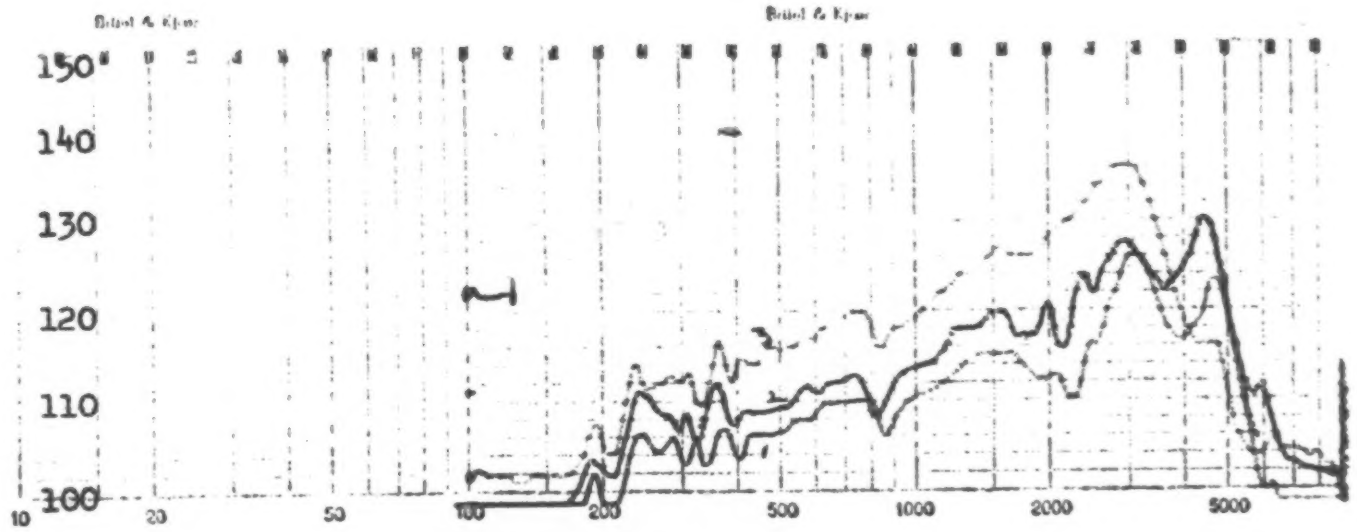


Figure 5 - Comparison between headset W-1-L and headset W-1-B using same amplifying unit. Input of 60 dB, gain set at maximum. Curve 1 is W-1-B with W-1 internal mic. only, curve 2 is W-1-B with internal mic. and external mic. (full gain), curve 3 is W-1-L.

QUALITY ASSURANCE

WARREN W1

1. Case appears to be hard plastic material. Ability to withstand shock, handling, dropping, etc. questionnable. Mounting of controls does not permit easy operation. Control movement is restricted by lack of clearance from case opening.

2. Batteries are readily replaceable without unsoldering of wire leads.

3. Soldering of circuit board is fair to poor. An excessive amount of solder has been used and solder flux has not been cleared from board. The use of paper as an insulator between solder lands and interconnecting wires is poor practice.

4. Parts density on the circuit board is relatively high. Parts are standard commercial type.

5. Service maintainability is considered to be fair.

EDUCATIONAL SURVEY

WARREN W1

1. Physical Description

The Warren Model W1 may be used alone as an individual aid or in combination with the Warren Model T2. The W1 is a self contained portable, monaural unit and battery operated. The batteries are replaceable but not rechargeable. Cushion or muff type earphones are available with a boom microphone attached to the muff type. The headbands of both the cushion and muff type are stiff and uncomfortable. Controls are student operated where the Warren W1 is used as an individual aid. The main unit is controlled by the teacher when the W1 is used with the Model T2. Student mobility is unlimited where the Warren Model W1 is functioning as a hearing aid and unlimited in the classroom where used with the loop. Batteries are easily replaced. Repairs should be made by an electronics technician.

2. Quality

Workmanship on the Warren Model W1 is judged to be generally unsatisfactory.

3. Performance

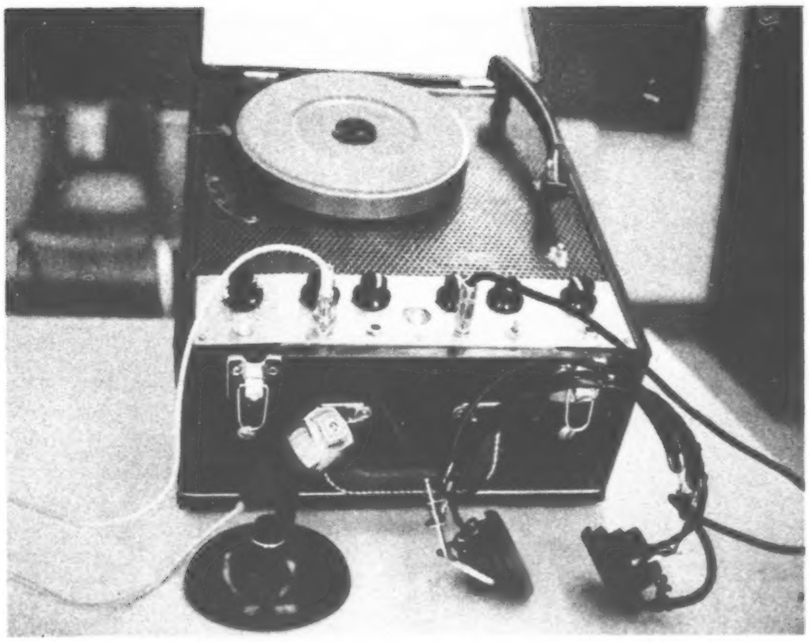
Although frequency response meets the criteria for fair, this response except in some high frequency hearing losses is not considered ideal. The instruments within a given model vary in performance characteristics.

4. Educational Suitability

Warren Model W1	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

Warren Model W1 with Model T2	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

WARREN



AUDITORY TRAINER CONSOLE

W2-S

ACOUSTICAL RESPONSE

WARREN W2-S

Frequency response uniformity, Figure 1, was found to be fair by our rating criteria. There was found to be a 9 dB valley centered at 1800 Hz followed by a sharp 11 dB rise and another 11 dB valley.

Harmonic distortion was found to be very low.

Uniformity between channels was found to be excellent. (see Figure 5.)

Gain control calibration was excellent, however, the numbering on the dial plate might be confusing to some users. (see Figure 3).

Power output control calibration was only fair as the acoustic outputs we measured varied by as much as 8 dB from that which was marked on the dial plate. (see Figure 4.)

The two microphones supplied with the trainer provides for different response characteristics as shown in Figure 6.

Compression action was rated as poor. Attack time was 600 milliseconds with an overshoot of 4 dB and an undershoot of 5 dB. Recovery time was 1000 milliseconds with only a 2 dB undershoot which makes the long recovery time less objectionable.

ACOUSTICAL SUMMARY

Mode	HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
J. L. Warren earphones with cushion	58	180 - 9200	135

WARREN W2-S

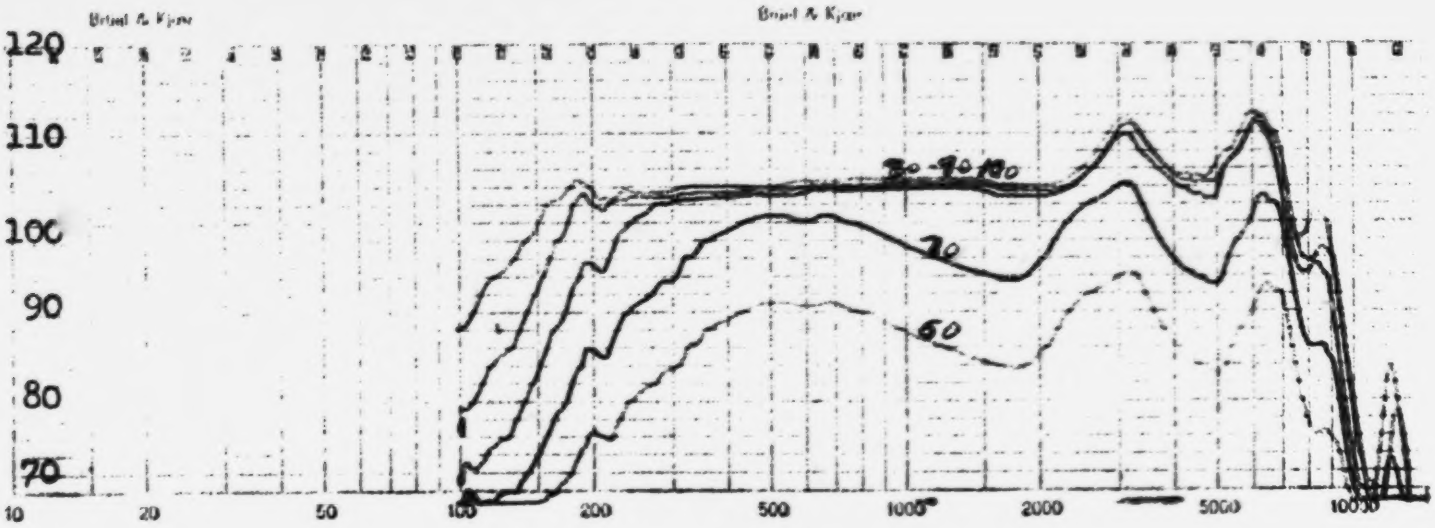


Figure 1 - Series of curves with inputs of 50 dB to 90 dB; mic. sensitivity set at maximum (35 dB), binaural control set at 110 dB (MPO).

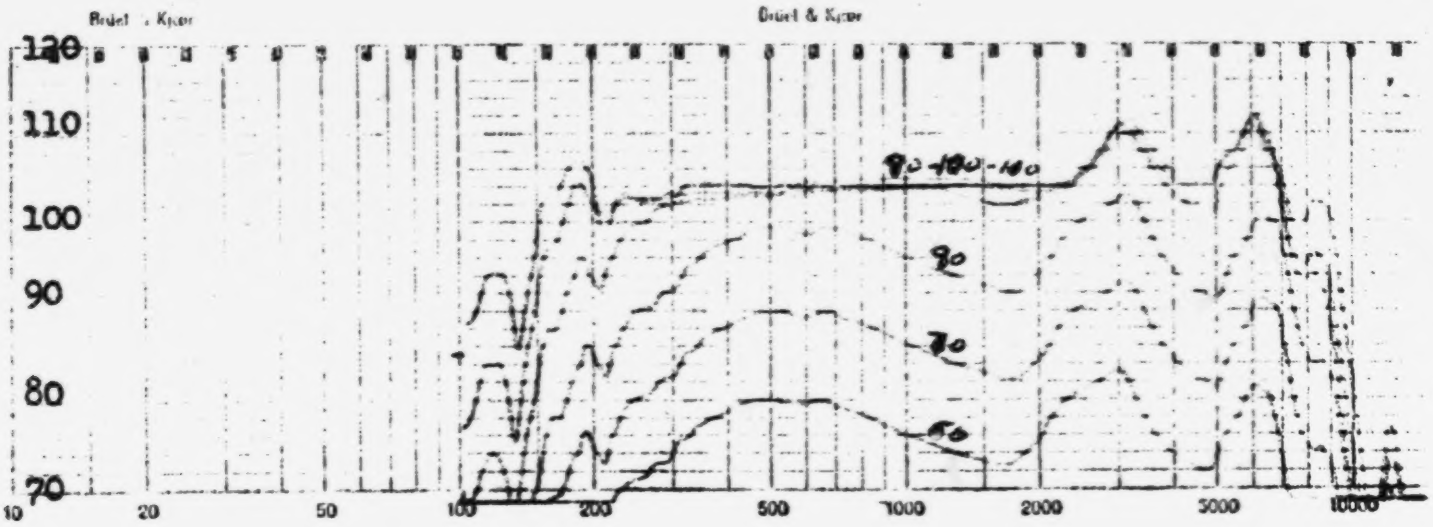


Figure 2 - Series of curves with inputs of 50 dB to 100 dB showing the effect of changing mic. sensitivity control to 45 dB, i.e., down 10 dB; binaural control set at 110 dB (MPO).

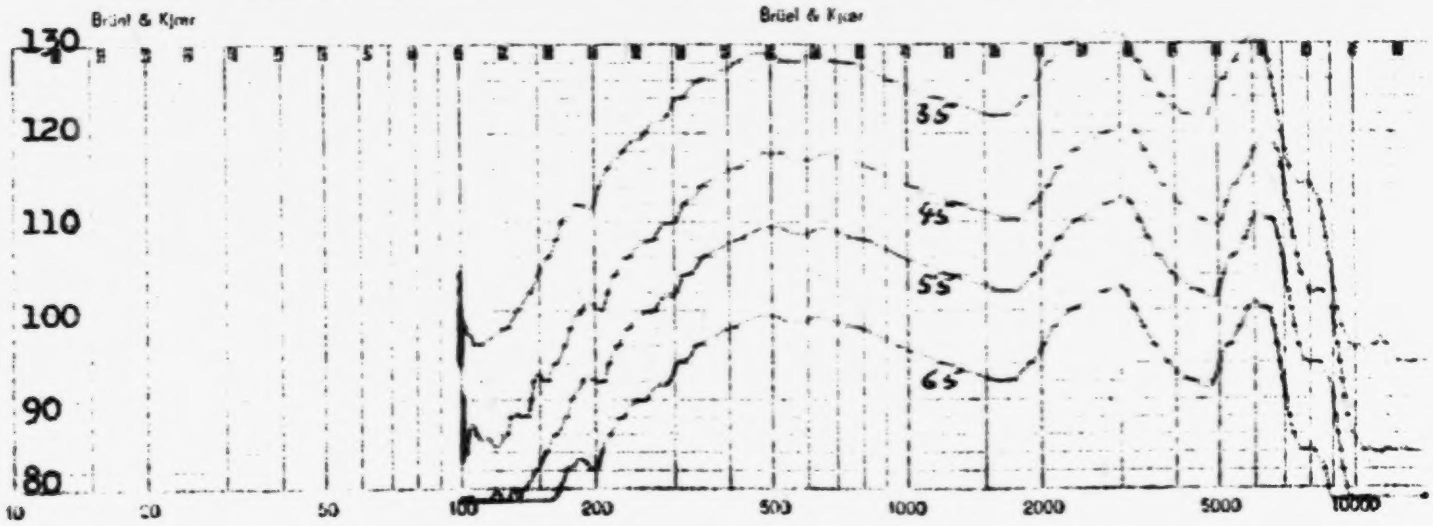


Figure 3 - Linearity of mic. sensitivity control. Input of 60 dB. Mic. sensitivity set at 65, 55, 45, & 35 dB. Binaural control set at 140 dB.

WARREN W2-S

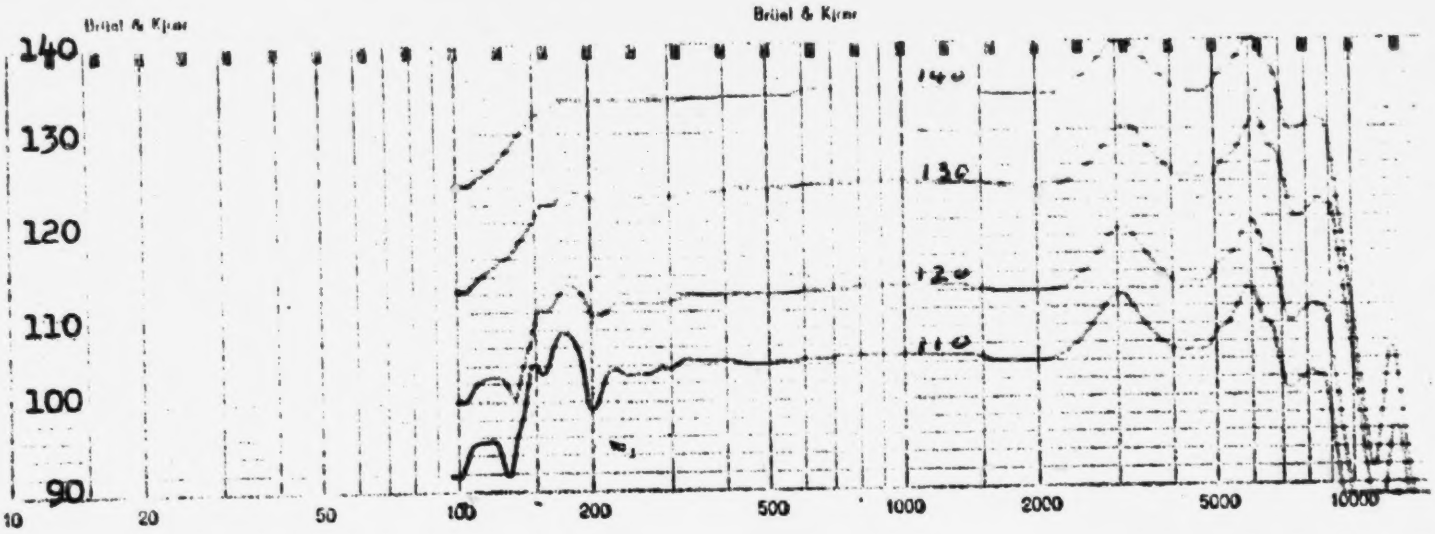


Figure 4 - Linearity of binaural control. Input of 100 dB. Mic. sensitivity set at maximum, binaural control set at 110, 120, 130, & 140 dB.

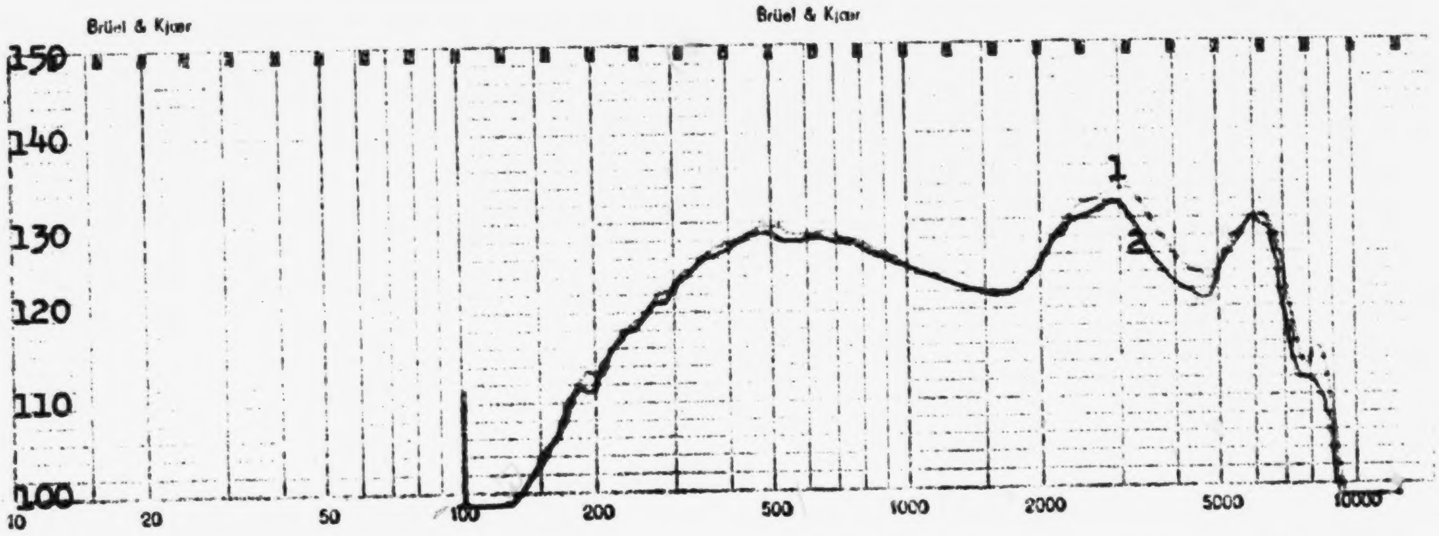


Figure 5 - Uniformity between right (1) and left (2) earphones. Input of 60 dB. Mic. sensitivity set at maximum, binaural control set at maximum.

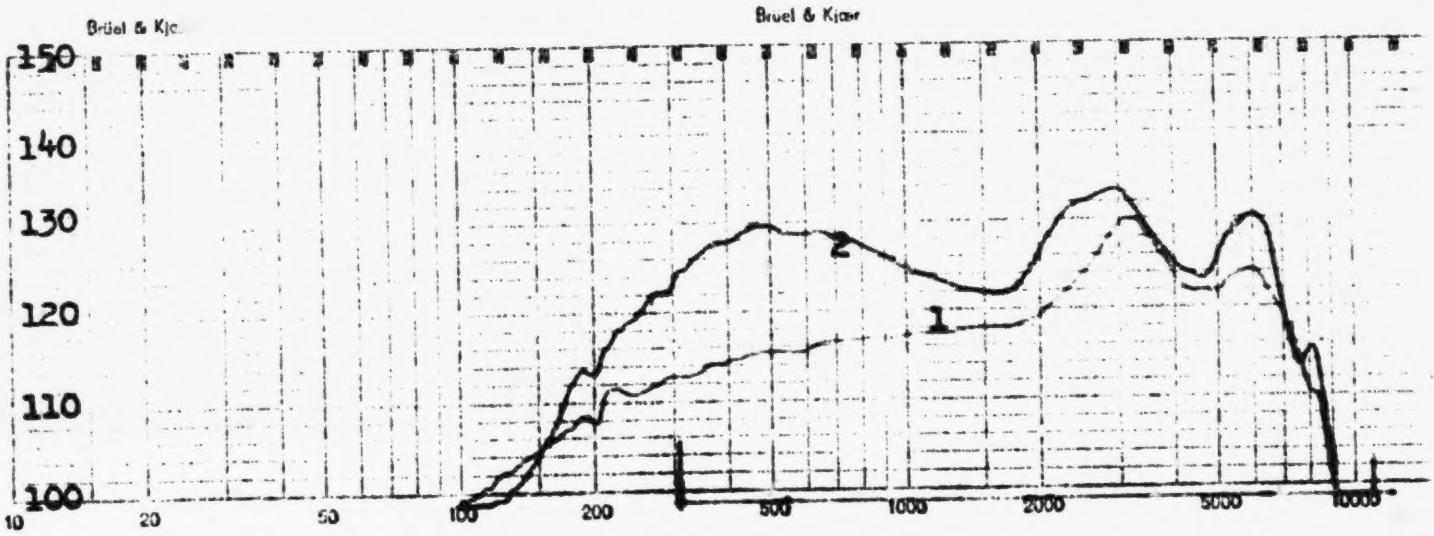


Figure 6 - Difference in response between Shure 777 mic. (1) and Astatic 335 H mic. Input of 60 dB. Mic. sensitivity set at maximum, binaural control set at maximum.

WARREN W2-S

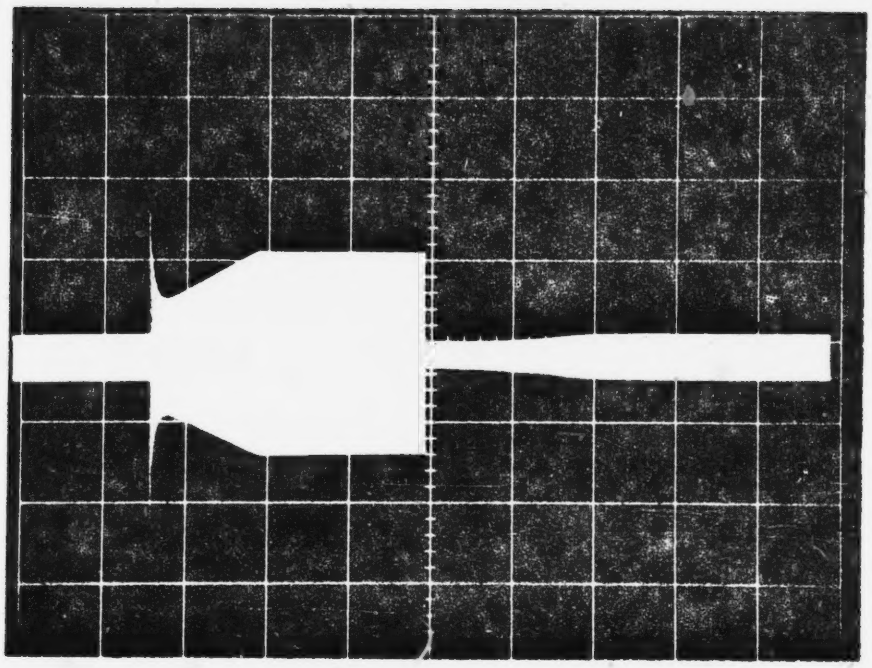


Figure 7

Attack and release times of compression sequence. Mic. sensitivity set at 35 dB, binaural control set at 140 dB maximum. Input sequence of 60-80-60 dB. Base line calibration 0.5 sec/div.
60 dB input = 122 dB output.
80 dB input = 136 dB output.
Attack overshoot 4 dB.
Attack undershoot 5 dB.
Recovery undershoot 2 dB.
Attack time 600 ms.
Recovery time 1000 ms.

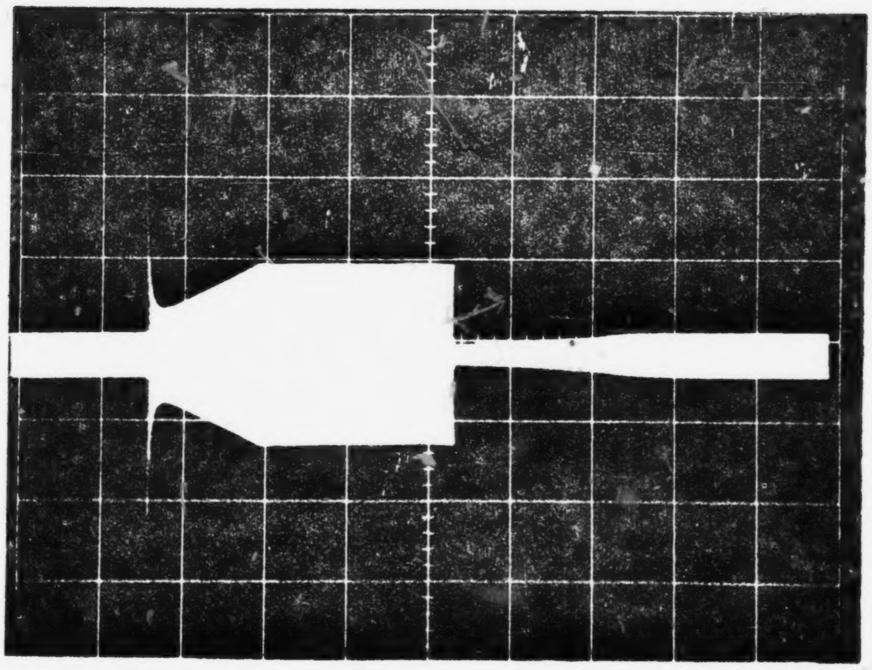


Figure 8

Attack and release times of compression sequence. Mic. sensitivity set at 35 dB, binaural control set at 110 dB. Input sequence of 60-80-60 dB. Base line calibration 0.5 sec/div.
60 dB input = 87 dB output.
80 dB input = 101 dB output.
Attack overshoot 4 dB.
Attack undershoot 5 dB.
Recovery undershoot 2 dB.
Attack time 600 ms.
Recovery time 1000 ms.

QUALITY ASSURANCE

WARREN W-2S

1. Chassis is standard commercial radio type. Switch and control arrangement is satisfactory. Outer case is vinyl covered wood.

2. General arrangement of parts on chassis is such as to cause congestion and inaccessibility to solder terminals. Inaccessibility results from wiring which because of lack of proper spacing of parts, lies directly over terminal points.

3. Soldering and general workmanship are limited by the constraints of parts arrangement mentioned above. The practice of soldering tube sockets to the chassis is undersirable and could lead to maintenance problems.

4. Parts are standard commercial type.

5. Service and maintainability are poor.

EDUCATIONAL SURVEY

WARREN W2-S

1. Physical Description

The Warren W2-S is a vacuum tube hard wire monaural fixed position type system, in which a loop can be added. It is AC powered. This model can be moved about quite easily. Separate volume control for each ear may be adjusted by the students on dual control mounted boxes. The teacher's microphone may be either a stand or a lavalier type. The length of the cord limits the teacher's mobility. This model limits student stations to four. There are two microphone inputs. There are no individual student microphones. One microphone may be passed around the four stations. The headphones are H2 receivers with two head bands which are hard, uncomfortable and demonstrate little flexibility or adjustability. Servicing requires an electronics technician.

2. Quality

Workmanship on the Warren Model W2-S is judged to be generally unsatisfactory. The use of vacuum tubes is generally obsolete. The turntable and tone arm are unsatisfactory.

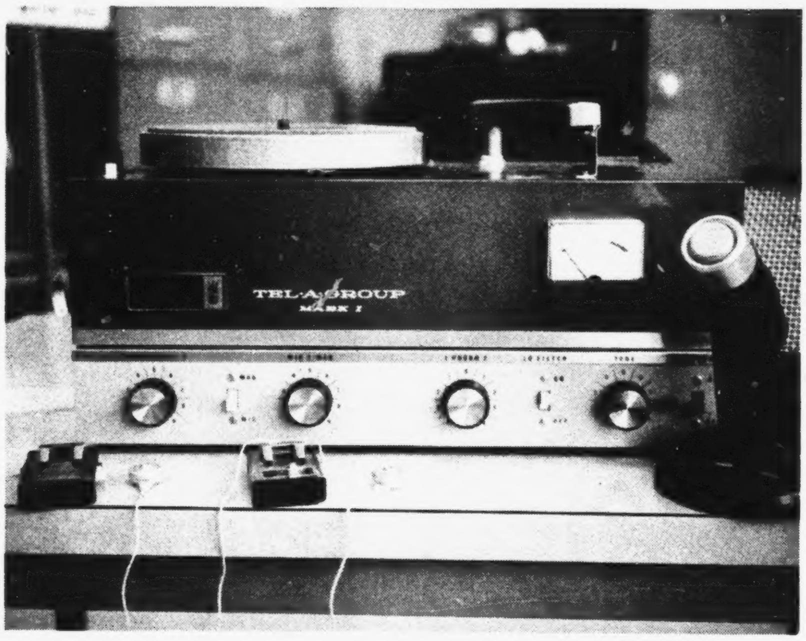
3. Performance

The performance of compression amplification circuit is unsatisfactory. The use of vacuum tubes generates excessive heat which makes part of the case hazardous to touch and may warp records.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X		
Elementary	X	X	X	X		
Secondary	X	X	X	X		

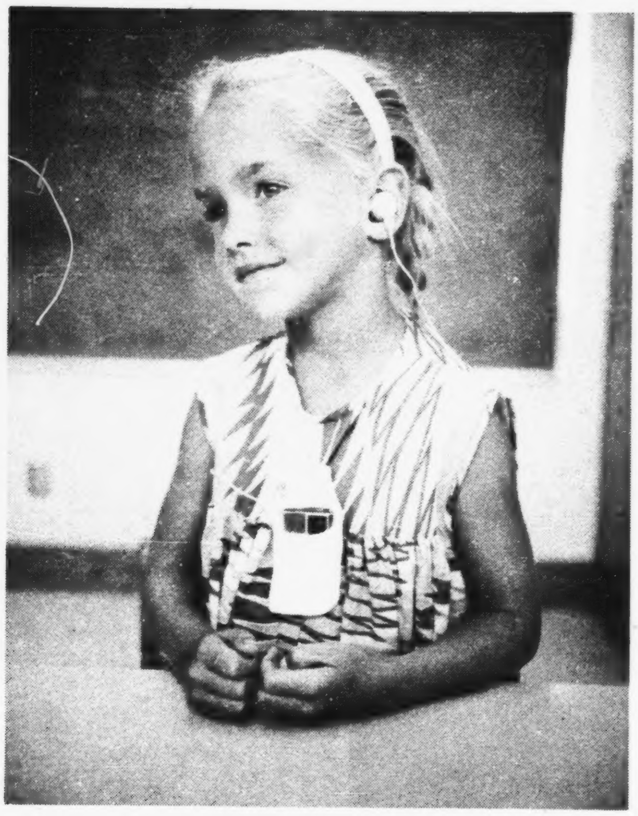
ZENITH


TEL-A-GROUP
MARK I

TEL-A-GROUP MARK I ZA

with SUPER EXTENDED RANGE

and VOCALIZER HEARING AIDS



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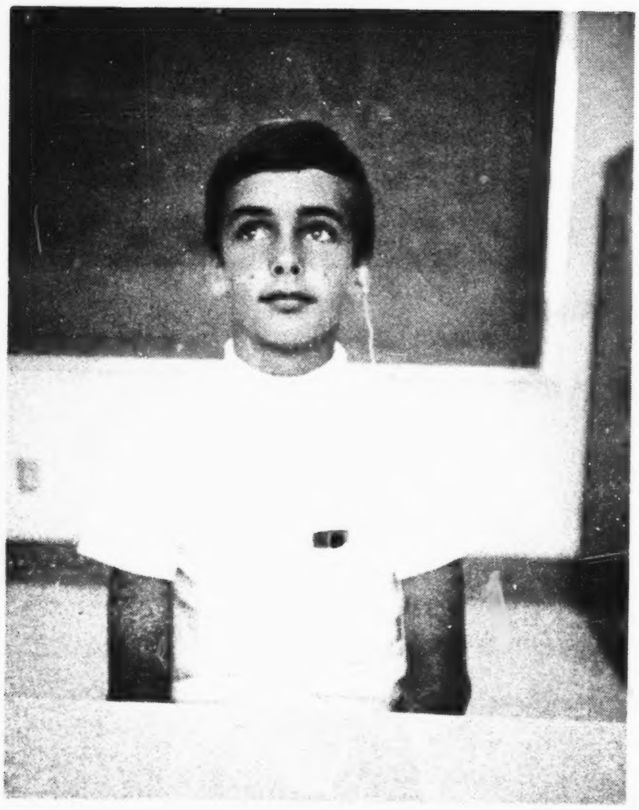
TEL-A-GROUP MARK I ZA

with SUPER EXTENDED RANGE and

VOCALIZER HEARING AIDS



ACOUSTICAL RESPONSE

ZENITH TEL-A-GROUP
With Super Extended Range Hearing Aid

Frequency response uniformity, Figure 1, was found to be good by our rating criteria.

Harmonic distortion was found to be very low and not exceeding 5%. (see Figure 2.)

This is a monaural system unless a Y cord is used or if two hearing aids are used.

The Super Extended Range Hearing Aid has a tone control which is reported on under the hearing aid alone.

ACOUSTICAL SUMMARY

HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
37	150 - 3500	130

ZENITH TEL-A-GROUP
With Super Extended Range Hearing Aid

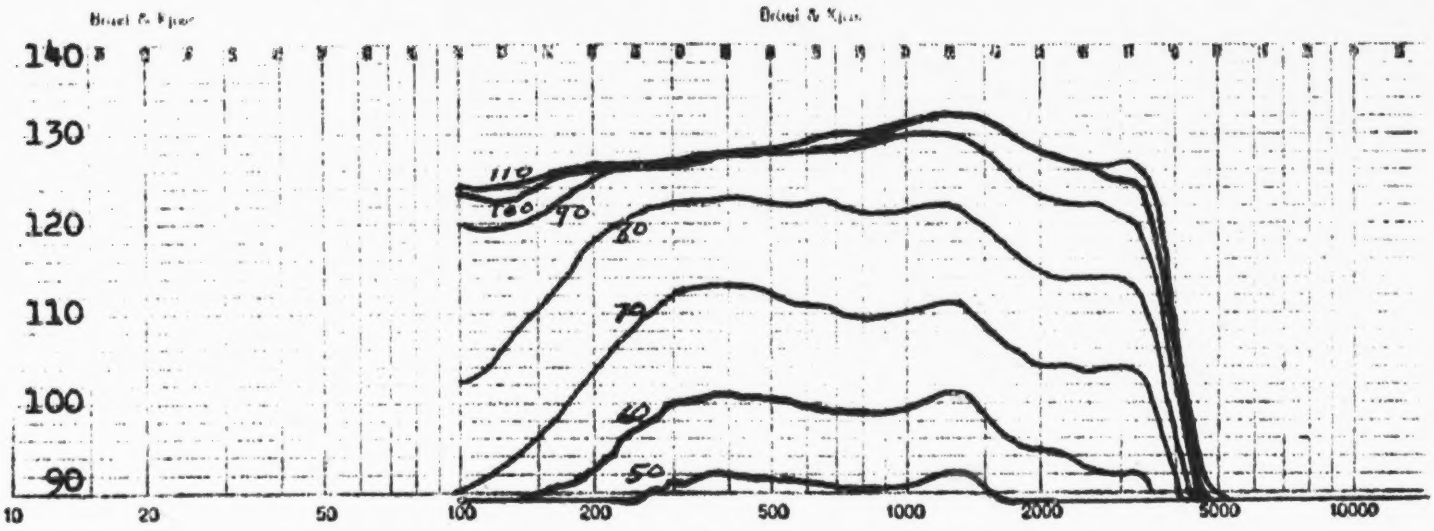


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, 90, 100, & 110 dB. Tel-A-Group mic. control set at red line at 1000 Hz with 80 dB input. Hearing aid gain control set at maximum. Tone control set at C.

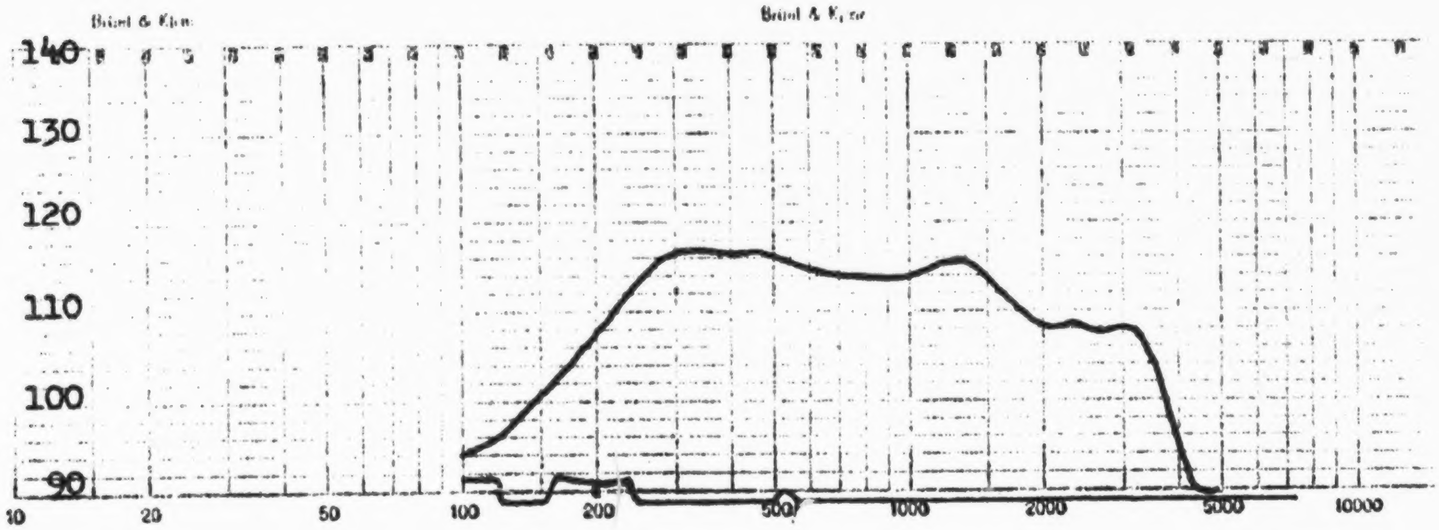


Figure 2 - Second Harmonic distortion with input of 70 dB. Tel-A-Group mic. set to red line at 1000 Hz with 80 dB input. Hearing aid gain control set at 5 dB below maximum.

ACOUSTICAL RESPONSE

ZENITH TEL-A-GROUP
With Vocalizer Hearing Aid

Frequency response uniformity, Figure 1, was found to be good by our rating criteria.

Harmonic distortion was found to be very low.

This is a monaural system unless a Y cord is used or if two hearing aids are used.

ACOUSTICAL SUMMARY

HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
40	100 - 4000	131

ZENITH TEL-A-GROUP
With Vocalizer Hearing Aid

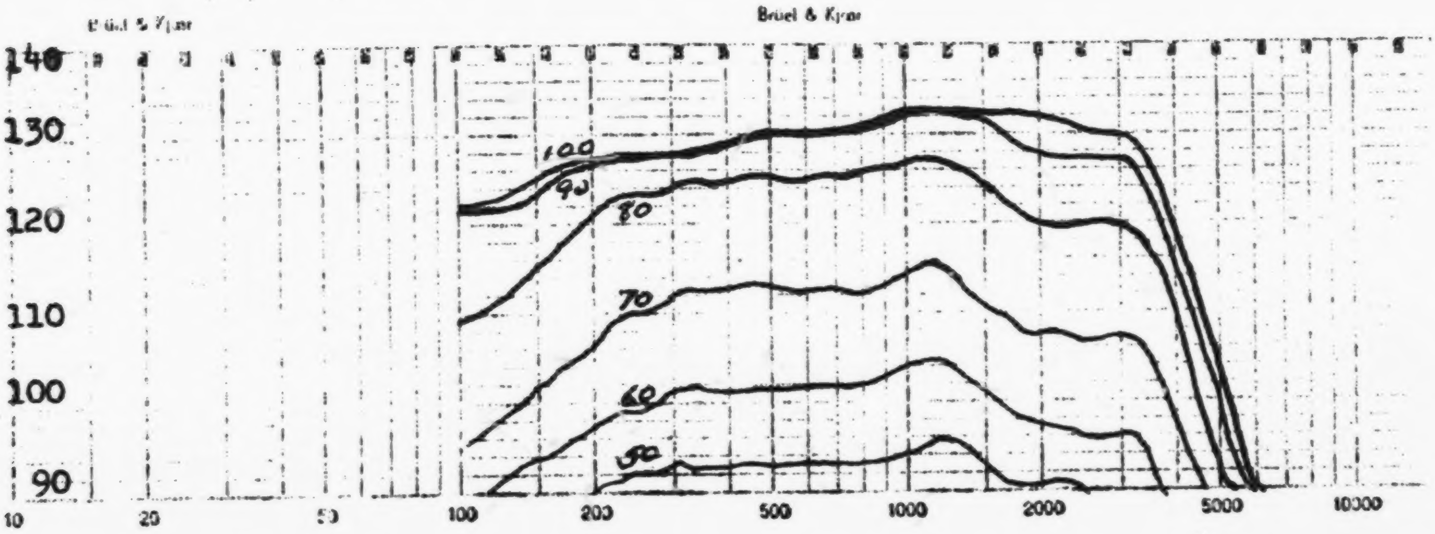


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, 90, & 100 dB. Tel-A-Group mic. control set to red line at 1000 Hz with 80 dB input.

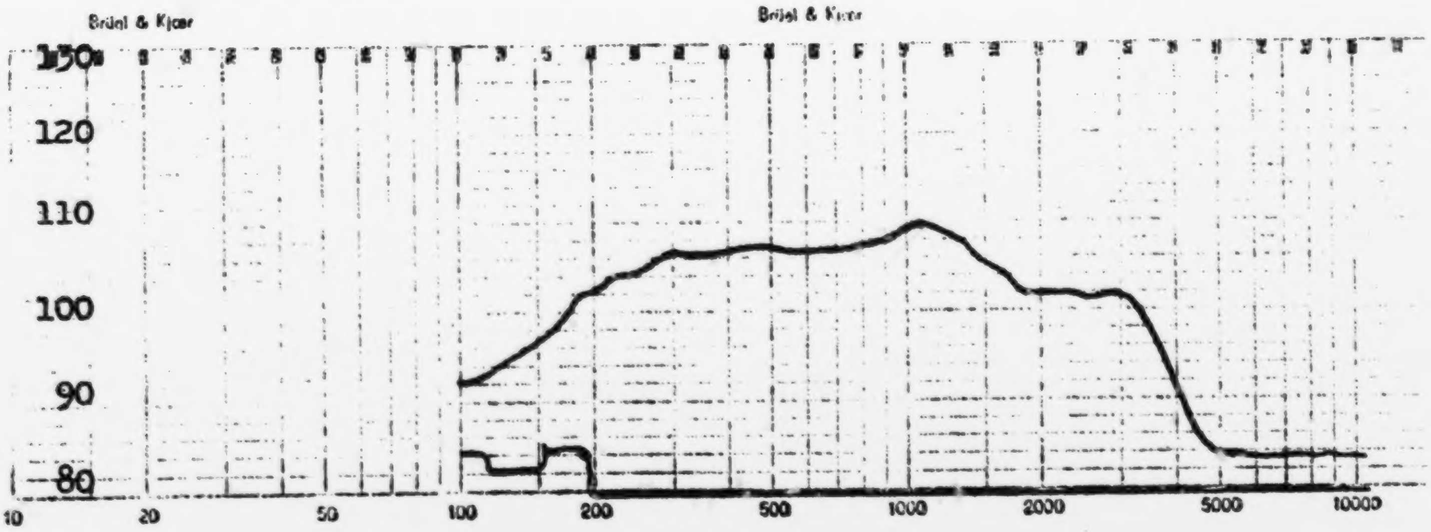


Figure 2 - Second Harmonic distortion with an input of 70 dB. Tel-A-Group mic. control set to red line at 1000 Hz with 80 dB input. Hearing aid gain set at 5 dB below maximum.

QUALITY ASSURANCE

ZENITH TEL-A-GROUP Mark I ZA

1. Metal enamelled case and chassis. Good serviceability.
2. Controls are arranged well and markings are easily read.
3. General arrangement of parts permits ready access to terminal points.
4. Soldering and wiring reflect good workmanship.
5. Parts appear to be high quality commercial type.
6. Service and maintainability aspects are excellent.

ZENITH

SUPER EXTENDED RANGE

ACOUSTICAL RESPONSE

ZENITH SUPER EXTENDED RANGE HEARING AID

Frequency response uniformity, Figure 1, is good.

Harmonic distortion, Figure 2, is good with a maximum of 9% being recorded at 650 Hz.

Tone control variability for this four-step control, Figure 3, is good.

ACOUSTICAL SUMMARY

HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
58	290 - 5000	130

ZENITH - SUPER EXTENDED RANGE II HEARING AID

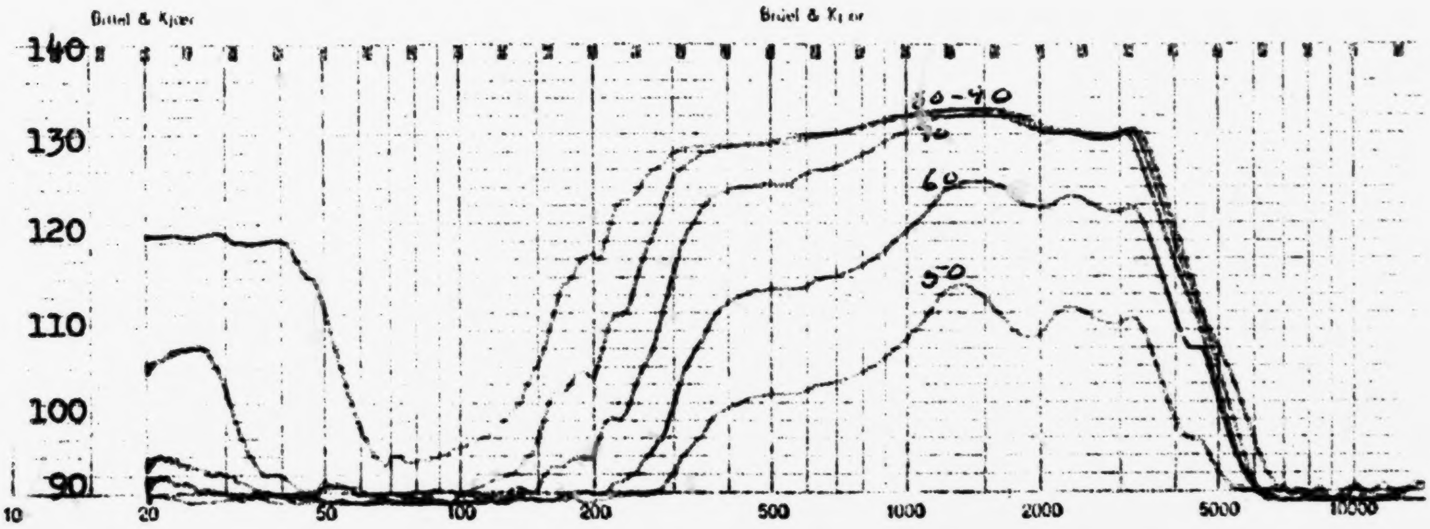


Figure 1 - Series of curves with inputs of 50, 60, 70, 80, & 90 dB. Volume control set at maximum. Tone control set at flat position (C).

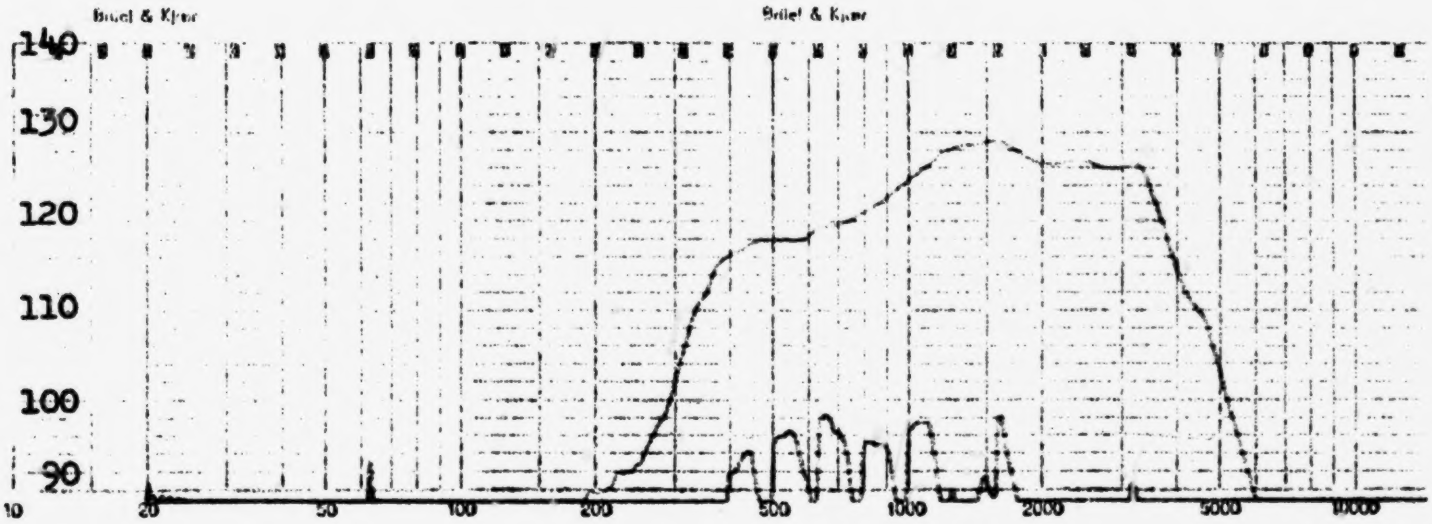


Figure 2 - Second Harmonic distortion with input of 70 dB. Volume control set at 5 dB below maximum. Tone control set at flat position (C).

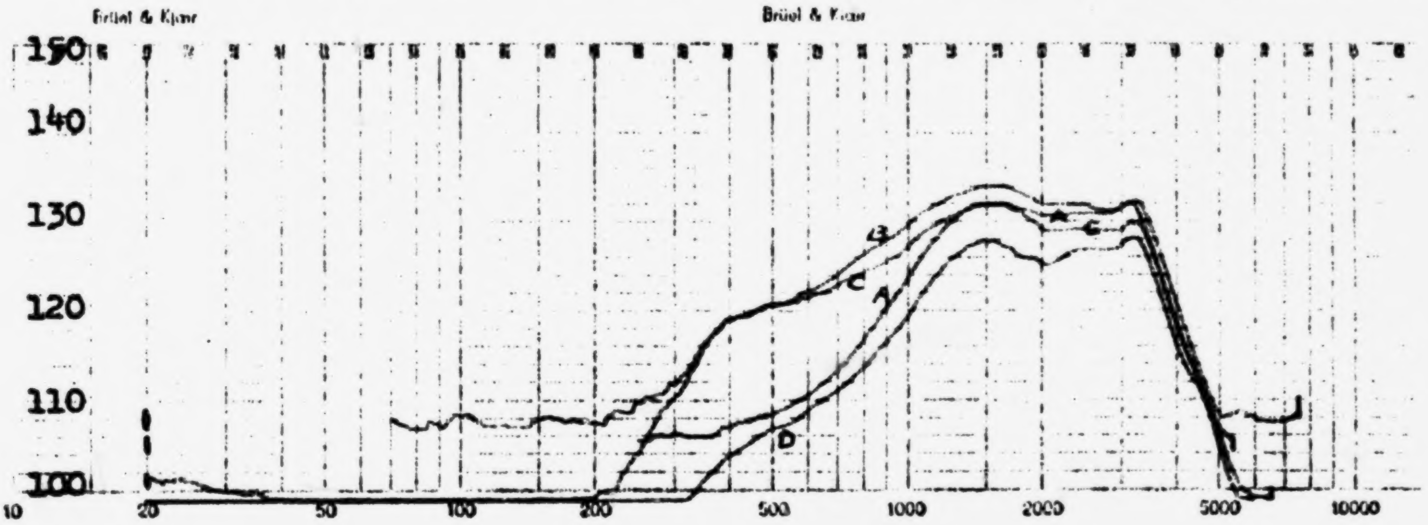
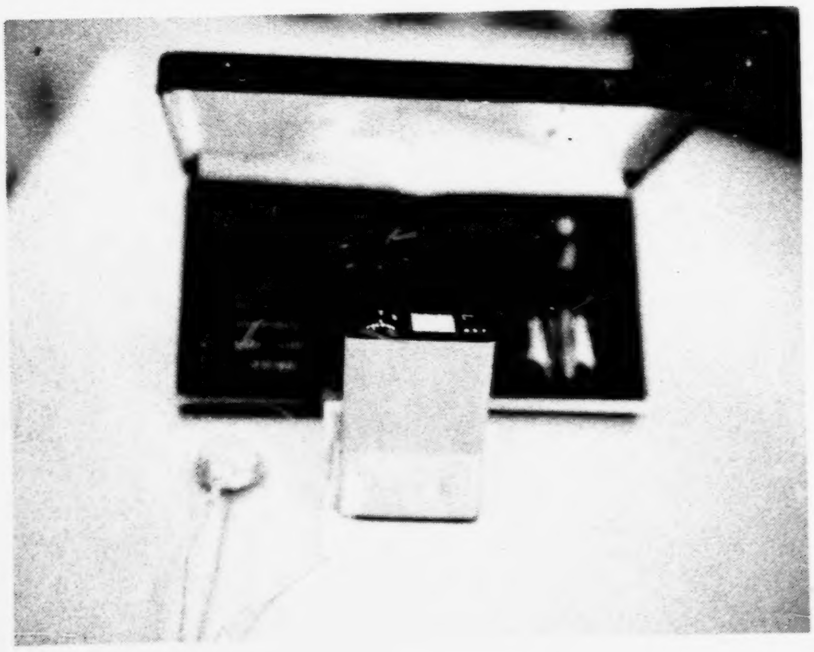


Figure 3 - Effect of tone control with input of 60 dB. Volume control set at maximum. Tone control set at A, B, C, & D.

ZENITH



VOCALIZER

ACOUSTICAL RESPONSE

ZENITH VOCALIZER HEARING AID

Frequency response uniformity, Figure 1, is fair showing a 6 dB rise from the normal curve and then a 6 dB valley followed by an 8 dB rise.

Second harmonic distortion was found to be very low.

ACOUSTICAL SUMMARY

HAIC Gain - dB	HAIC Range - Hz	HAIC MPO - dB
49	150 - 5500	132

ZENITH VOCALIZER II HEARING AID

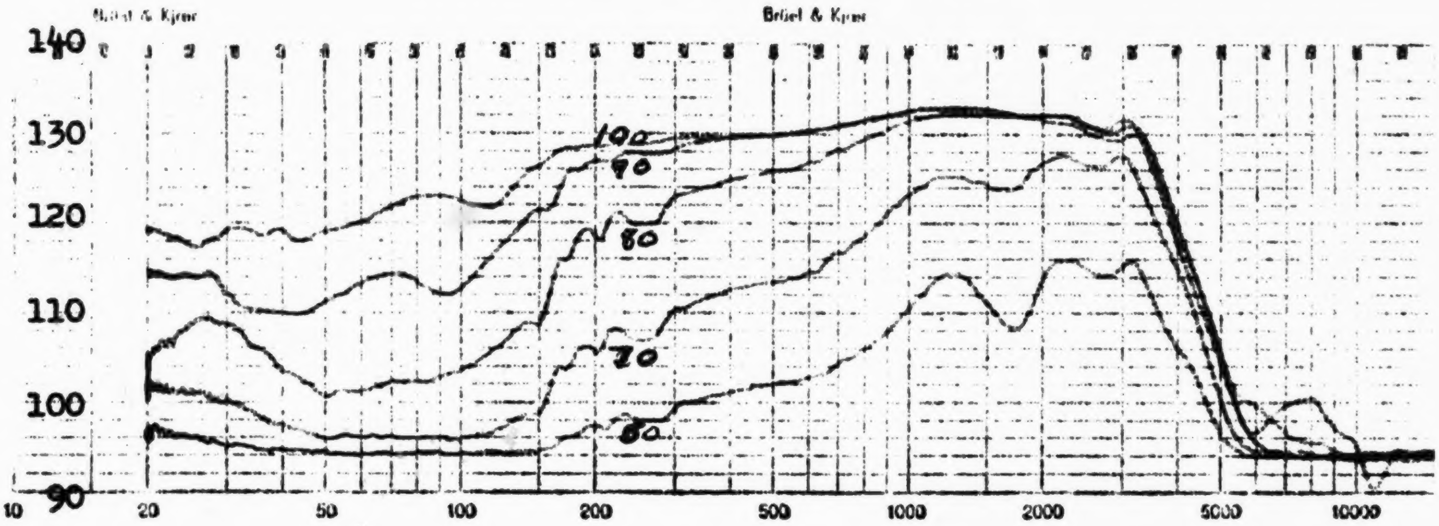


Figure 1 - Series of curves with inputs of 60, 70, 80, 90, & 100 dB.
Volume control set at maximum.

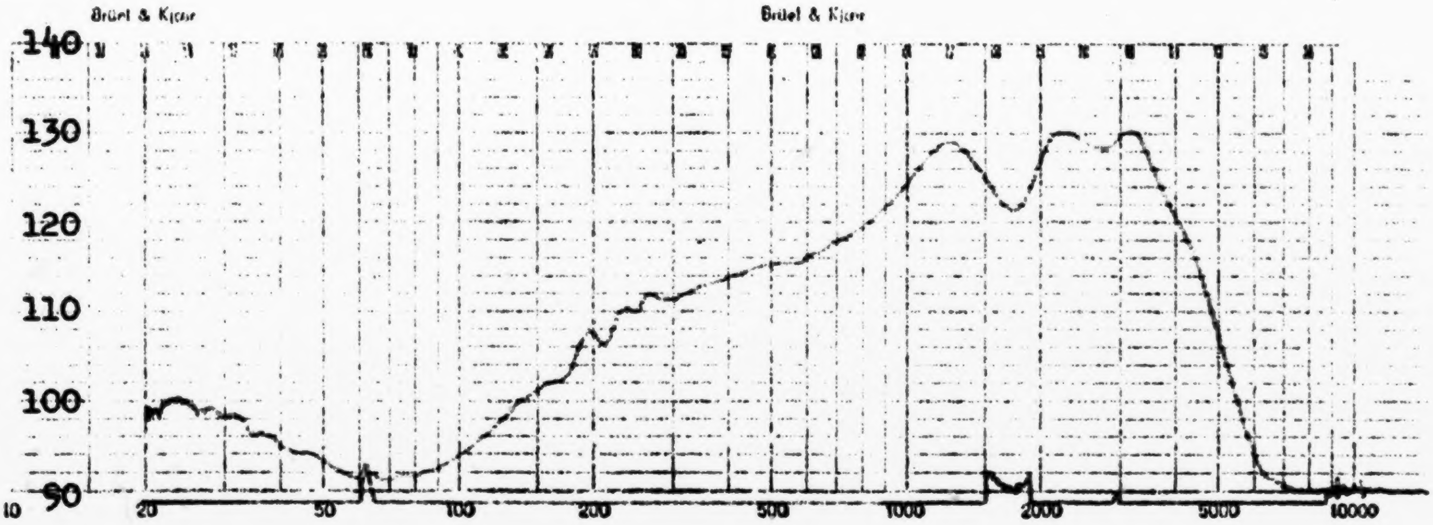


Figure 2 - Second Harmonic distortion test. Input of 70 dB. Volume control set at 5 dB below maximum.

QUALITY ASSURANCE

ZENITH HEARING AID, VOCALIZER & EXTENDED RANGE

1. Inner plastic frame slips into exterior metal carrying case providing good protection.

2. Switch and volume control work well.

3. General arrangement of parts is fair.

4. The soldering of the circuit board is fair. Solder is somewhat excessive throughout the board. The use of interconnecting wires indicates that the circuit board geometry has been obsolete or is used for other instruments. This is also indicated by unused lands.

5. The service and maintainability aspects of this device are somewhat compromised by the conditions mentioned above.

EDUCATIONAL SURVEY

ZENITH TEL-A-GROUP Mark I ZA with SUPER EXTENDED RANGE AND ZENITH VOCALIZER HEARING AIDS

1. Physical Description

This is an audio induction loop training and communication system with fixed master unit. Student units consist of self-contained individual hearing aid type units allowing mobility within the range of the loop. This system requires expert electronic installation to minimize spill-over into adjacent classrooms. It was noted that the internal induction pick-up coil (tel coil) is engineered to be oriented at a 45 degree angle, so that signal strength is not lost when the user bends over or lies down. AC power in main control unit. Student units are DC powered with replaceable 1½ volt (hearing aid type) batteries. Microphones consist of table stand and lavalier for teacher. Teacher mobility is limited by the length of cable. The student microphone is contained in individual hearing aid unit. No headphones--insert receivers only. Main control operated by teacher with individual control operated by student.

2. Quality

Consistently good construction and workmanship in master unit. Turn table and tone arm of unsatisfactory quality. Maintainability is rated as excellent. Student hearing aid units may be maintained through a hearing aid servicing facility.

3. Performance

Generally satisfactory performance providing installation is done by an electronics expert.

4. Educational Suitability

	INDIVIDUAL		SELF CONTAINED		INTEGRATED	
Ed. Levels	Deaf	H.H.	Deaf	H.H.	Deaf	H.H.
Pre-school	X	X	X	X	X	X
Elementary	X	X	X	X	X	X
Secondary	X	X	X	X	X	X

RECOMMENDATIONS

RECOMMENDATIONS

1. Manufacturers should provide specific information for the classroom teacher such as a trouble-shooting guide, a procedure for daily checking the system, what minor repairs the teacher can be expected to perform and those which she should not attempt to perform.

2. Industry should attempt to develop improved systems for checking operational quality of amplification systems.

3. Quality of components and workmanship in educational amplification equipment should be improved possibly utilizing electronic advances made in the space industry. Obvious low quality items should be discontinued such as plastic chin-loop insert receivers, low quality turntables and tone arms.

4. Manufacturers and sales representatives should seek to provide up-to-date information for school officials preparing and ordering educational amplification. It would be most helpful to package equipment so that all necessary components or parts essential for classroom operation are identified.

5. Manufacturers should develop equipment suitable in size and performance for young preschool age deaf and hard of hearing children.

6. Hearing aid manufacturers should standardize the positioning of the internal induction coil so that every child's individual aid is compatible and effective within a system.

7. Industry needs to give a larger portion of research to the specific amplification needs of deaf and hard of hearing children, both in considering classroom and individual amplification.

8. Industry should vigorously pursue a program of alerting and explaining new products, refined instrumentation and changed performance characteristics of their products in the field of educational amplification, to educators of the deaf and hard of hearing.

9. Plans should be made by school programs to yearly check operational quality (electronic and mechanical) of educational amplification equipment.

10. School programs should establish replacement schedules for educational amplification equipment. It is suggested that replacement of equipment should be considered five years after the date of purchase.

11. School programs installing educational amplification equipment in classrooms for deaf and hard of hearing pupils, should secure expert assistance from engineers so as to maximize the acoustical quality of the room and the performance of the equipment.

12. Maintenance and repair service by qualified electronic technicians is desirable for all types and models of equipment. School districts should assure quality performance of the equipment by establishing definite service arrangements. It is essential that manufacturers supply these service sources with complete repair and parts manuals including schematics. Parts should be readily available to facilitate repairs and replacements.

13. Study should be given to the development and use of additional microphones in classrooms so that every deaf and severely hard of hearing pupil can monitor himself and others better.

14. Teachers should be provided current operational instructions and whatever orientation necessary to use the equipment in the classroom.

15. More attention should be given to fitting appropriate amplification on children in the classroom setting, i.e. correct and suitable amplification for every child in the class or group setting is as critical as fitting individual amplification.

16. Colleges preparing teachers of the deaf and hard of hearing should provide courses relating to educational amplification. The coursework should include a study of the acoustical and educational performance--characteristics critical as instructional variables.

17. There should be considerable attention given to developing precision of the professional language of teachers, supervisors, consultants, audiologists, engineers and administrators relative to educational amplification.

18. This kind of study must be repeated at three-year intervals in order to assure continuing improvements in educational amplification equipment used in classrooms for deaf and hard of hearing children. The study should involve representative personnel similar to this pilot effort.

APPENDIX

EDUCATIONAL AMPLIFICATION RESPONSE STUDY QUESTIONNAIRE

E.A.R.S.

AGENCY INITIATING STUDY PROPOSAL:

California State Department of Education
Bureau of Physically Exceptional Children

Represented by:

Barry L. Griffing
&
Gordon M. Hayes

COOPERATING AGENCY:

San Diego Speech and Hearing Center

PROJECT DIRECTOR:

Donald F. Krebs

INSTRUCTIONS

We have attempted to make this questionnaire a fairly simple one for you to fill out by keeping the number of essay type questions to a minimum. However, we have allowed some room for your comments. Please use the reverse side of the sheets if your comments are more extensive than space allows.

Answer each question to the best of your ability.

A few questions will require a ranking. In this case you should rate the answers in order of their importance. If some answers have no importance, then do not rate them.

After you have completed the questionnaire, please fold and place in the enclosed, self-addressed, stamped envelope and mail.

Thank you very much for your assistance in this study.

EDUCATIONAL AMPLIFICATION RESPONSE STUDY

E.A.R.S.

Questionnaire

NAME ______________________________

SCHOOL ______________________________

SCHOOL DISTRICT ______________________________

1. STUDENT CHARACTERISTICS (those that you work with).

   A. Age range ______________________________

   B. Hearing loss:
   If possible we would prefer copies of each childs audiogram less his name. If that is not possible then please fill in the blanks in the sub-section below.

   In filling in this section, please list the number of children you have in each hearing loss category. In establishing the levels of hearing, use the average of 500, 1000, & 2000 cycles for the better ear.

      a. mild hearing loss 20-40 dB ______________

      b. moderate hearing loss 40-60 dB ______________

      c. severe hearing loss 60-80 dB ______________

      d. profound hearing loss 80+ dB ______________

   C. What is the length of the school day for your students? ______________________

   D. Have most of your students been fitted with individual hearing aids? YES_____ NO_____

      a. number with monaural aids ____________

      b. number with monaural aids and Y cords. ____________

      c. number with binaural aids ____________

2. CLASSROOM FEATURES (classroom that you teach in).

A. Is it well insulated from outside noise? YES ___ NO ______

B. Is it well insulated from adjacent classroom noise? YES___ NO______

C. Does your classroom have acoustical tile on the ceiling? YES___ NO _____

D. Does your classroom have carpeting on the floor? YES___ NO _____

E. How do you rate the acoustics of your classroom. GOOD___ FAIR___ POOR___

F. What would you consider as ideal in the design of a classroom for deaf and hard of hearing students?

____

____

____

____

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____

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____

____

3. TYPE OF ELECTRONIC AUDITORY TRAINING EQUIPMENT USED AND ITS VALUE TO YOU IN TEACHING.

A. Make--______________________________

B. Model Number--______________________

C. How long have you used this particular model?

____

____

D. Do you use this equipment on all of your students? YES____ NO______

If no, why not? Explain.______________

____

____

____

____

____

E. What percentage of your school day is involved in the use of the auditory training equipment? ________%

COMMENT:______________________________

____

____

____

F. How old is the equipment?______________

____

G. Did some one orient you on how to use the equipment or did you have to figure it out for yourself?________________________

____

1. If you were oriented by someone else, please indicate by whom:

   a. ________another teacher
   b. ________your principal
   c. ________other school official
   d. ________salesman
   e. ________other

2. Was a manual supplied to you regarding the use of the equipment? YES_____ NO______

3. Do you feel that you have an adequate operating knowledge of the equipment you are using? YES ___ NO ___

COMMENT: ______________________________

____

____

____

____

4. Is the equipment you use easy to operate? YES ___ NO ___

COMMENT: ______________________________

____

____

____

H. Is the equipment accepted by the students? YES ___ NO ___

If no, why not? Explain. ________________

____

____

____

____

I. Which type of child seems to benefit most from the equipment?

____

____

____

____

____

____

____

J. In what areas of your instructional program is this equipment most helpful?

Rank the five most important ones from 1 to 5.

Auditory training-------	_____
Speech therapy---------	_____
Reading----------------	_____
Spelling---------------	_____
Social studies---------	_____
Opening exercises-------	_____
English----------------	_____
Rhythm-----------------	_____
Language training-------	_____
Other------------------	_____

COMMENT: ________________________________

____

____

____

____

____

K. Is equipment more useful in group or individual training? GROUP___ INDIV___

Do you use the equipment for: (check appropriate items)

________ Individual therapy

________ Group work

L. Has your classroom auditory training equipment had any observable effect on the students': (rank according to importance)

a. speech----------------- ______

b. language--------------- ______

c. social interaction------ ______

d. other------------------ ______

e. other------------------ ______

COMMENT: ______________________________

____

____

____

____

M. Does equipment perform better or worse than individual hearing aids? (check one only)

performs better ______

performs worse ______

about the same ______

COMMENT: ______________________________

____

____

____

____

N. To your knowledge, does the equipment you use distort at:

Low gain levels YES____ NO_____

Moderate gain levels YES____ NO_____

High gain levels YES____ NO_____

O. Is the gain and power output of your equipment adequate for your students' needs? YES ___ NO ___

P. What design improvements would you like to see in auditory training equipment from a teaching or therapy standpoint.

O. What other questions do you feel need answering?

R. What other comments do you have regarding the equipment you now use.

4. MAINTENANCE.

A. Does the equipment seem to hold up well under general use? YES____ NO_____

B. Program of preventative maintenance:

1 Does equipment get regular periodic checks? YES____ NO_____

2. Is this your responsibility? YES____ NO_____

3. Is this someone else's responsibility? YES____ NO_____

C. What has been your experience with respect to frequency of repair of your equipment?

____

____

____

D. Within your particular school district, how often is old equipment replaced with new equipment?

____

____

E. Any other comments regarding maintenance and replacement of equipment.

____

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ROUGH DISTORTION GUIDE

If the harmonic of the auditory trainer output is 0 dB down from the fundamental then the distortion is 100%

If it is 1dB " " " "	90
2	80
3	71
4	63
5	56
6	50
7	45
8	40
9	36
10	32
11	28
12	25
13	22.4
14	20
15	18
16	16
17	14
18	12.5
19	11
20	10
21	9
22	8
23	7
24	6.3
25	5.6
26	5
27	4.5
28	4
29	3.6
30	3.2
31	2.8
32	2.5
33	2.2
34	2
35	1.8
36	1.6
37	1.4
38	1.3
39	1.1
40	1

MANUFACTURERS

Acousta Auditory Training Units, Inc.
2919 Rhode Island, N.E.
Albuquerque, New Mexico 87110

Ambco Electronics
1222 Washington Boulevard
Los Angeles, California

Demaree and Associates
5248 Shearin Avenue
Los Angeles, California 90041

Eckstein Brothers
4807 West 118th Place
Hawthorne, California

Electronic Futures, Inc.
57 Dodge Avenue
North Haven, Connecticut 06473

H.C. Electronics, Inc.
1640-A Tiburon Boulevard
Tiburon, California 94920

Jay L. Warren, Inc.
721 West Belmont Avenue
Chicago, Illinois 60657

* RIL Electronics Corporation-A2
Street Road and 2nd Street Pke
Southampton, Pennsylvania 18966

Rolen Star Co.
445 Sherman Avenue, Suite G
Palo Alto, California 94306

Siemens Medical of America, Inc.
Box 353
La Canada, California 91011

Zenith Hearing Aid Sales
3333 Olympic Boulevard
Los Angeles, California

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* Equipment was not received in time to be used in this study.